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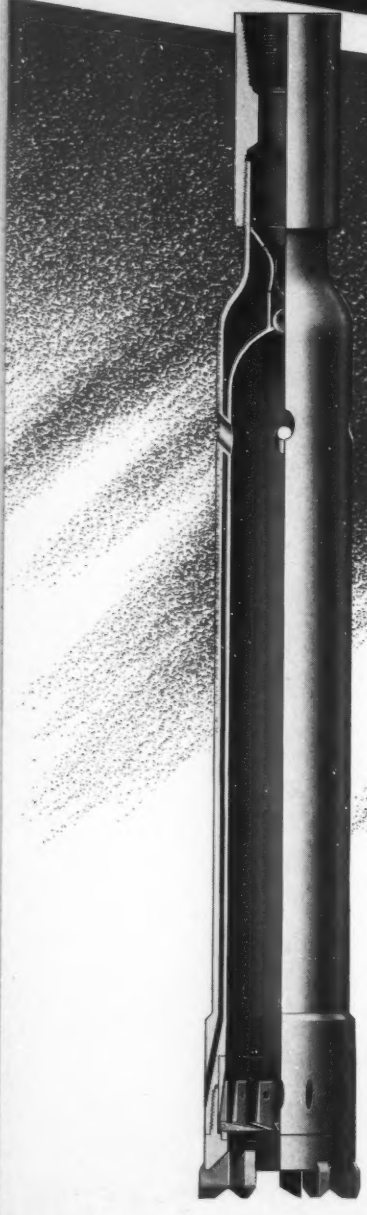

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The Bowen Junk Basket is a mighty handy fis
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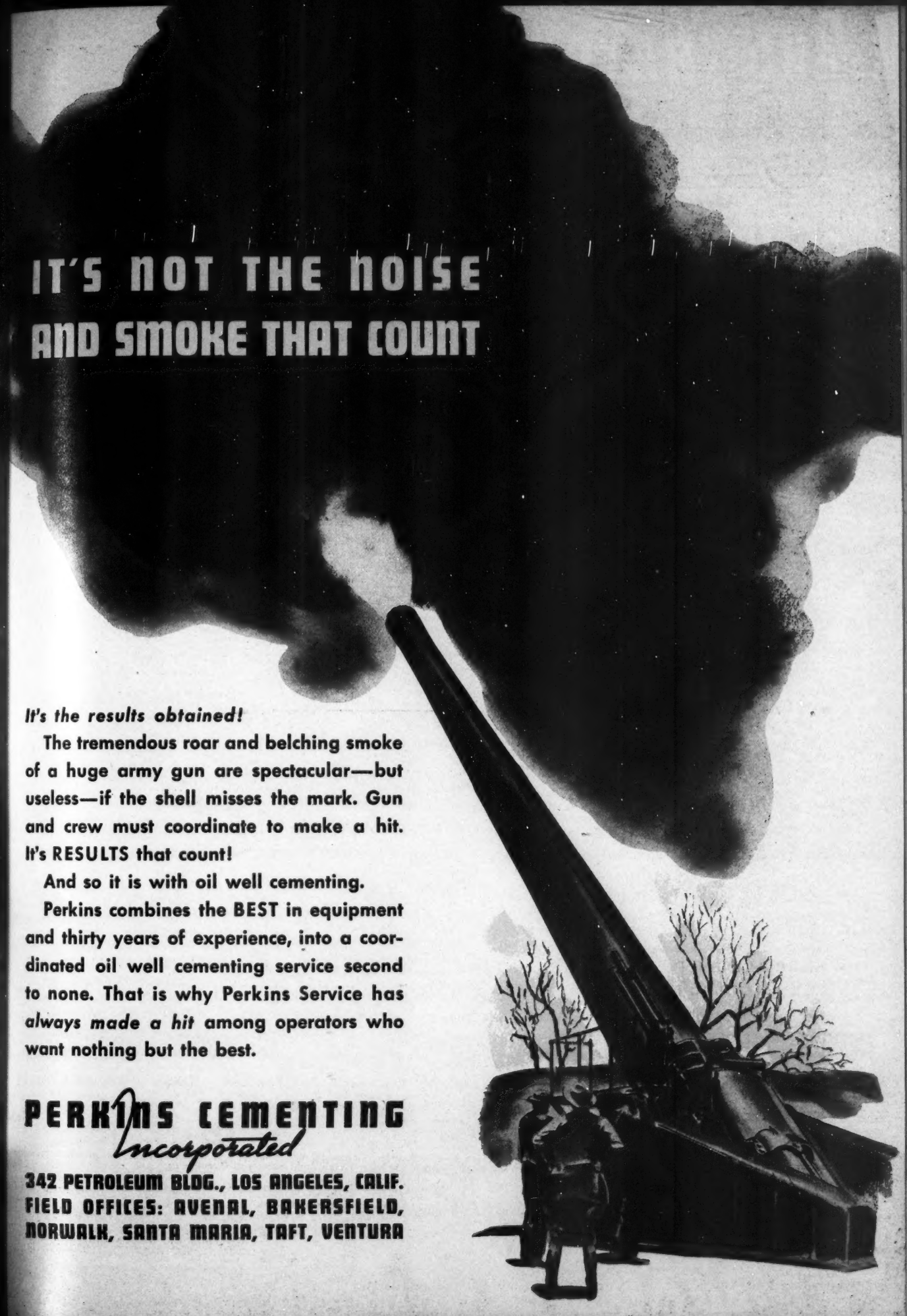

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CALIFORNIA
OIL WORLD
and Petroleum Industry

THE AUTHORITY ON THE CALIFORNIA OIL INDUSTRY

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February 24, 1940

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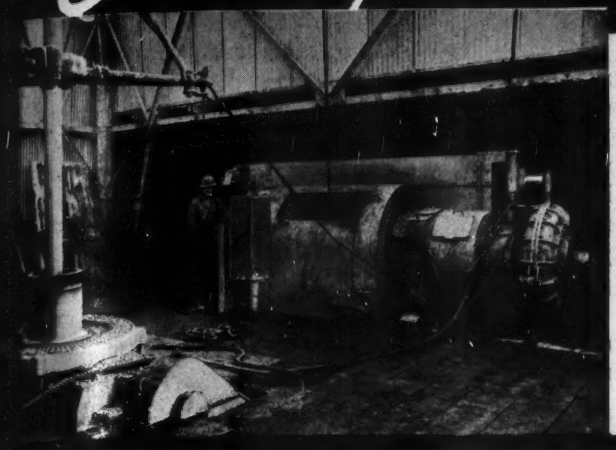
THE *Economy* of IDEAL ROTARY CHAIN

Shows to the Best Advantage Where Service Is Most Severe



CHAIN SERVICE in the Rio Bravo, California Field is particularly severe. Loads are heavy and speeds are high. Round trips, using 4½ inch drill pipe, are being made in less than 4 hours at 11,000 feet . . . In spite of an average of 85 round trips per well, Ideal No. 3⅛ Sprocket Chain is giving consistently long wear. Service records of 30,000 to 40,000 feet without appreciable chain wear are being reported in connection with Ideal Oil Bath Draw Works.

IDEAL No. 3⅛ Sprocket Chain is designed especially for high speeds and heavy loads. It is available in the single strand for driving rotary tables, catshafts, and other like requirements and in double strand for engine and heavy draw works drives. It is a precision type chain made to API Standards and is designed for operation on cut tooth sprockets.

BRIEF SPECIFICATIONS · No. 3⅛

Pitch in Inches	Number Links in Approx. 10 Feet	Ultimate Strength Pounds	Weight per Foot Pounds
Single 3.125	39	115,000	12.6
Double 3.125	39	230,000	24.6

IDEAL TYPE F Rotary Chain is designed for the regular requirements of deep and heavy drilling. It is an API standard precision type chain and is made from the same alloy steel as the Ideal No. 3⅛. In addition to unusual strength and resistance to wear and shock, effective delivery of lubricant to working parts is an important factor in its ability to operate with fewer replacements. It can be used on cast or cut tooth sprockets.

BRIEF SPECIFICATIONS · TYPE F

Pitch in Inches	Number Links in Approx. 10 Feet	Ultimate Strength Pounds	Weight per Foot Pounds
No. 3 API 3.075	39	75,000	8.5
No. 4 API 4.063	30	170,000	17.2

IDEAL TYPE G Rotary Chain fills the demand for a longer wearing chain for moderate loads. Although it is lighter in weight and proportionately lower in price than the deep well Ideal Type F, every part subject to wear is made from the same type of wear resistant alloy steel. This chain is of the commercial type and is made to API Standards.

BRIEF SPECIFICATIONS · TYPE G

Pitch in Inches	Number Links in Approx. 10 Ft.	Ultimate Strength Pounds	Weight per Foot Pounds
No. 3 API 3.075	39	48,000	7.3
No. 4 API 4.063	30	112,000	16.5

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Modern Surface Equipment Facilitates

Deep Drilling in California

By Wallace A. Sawdon
Petroleum Engineer, Los Angeles

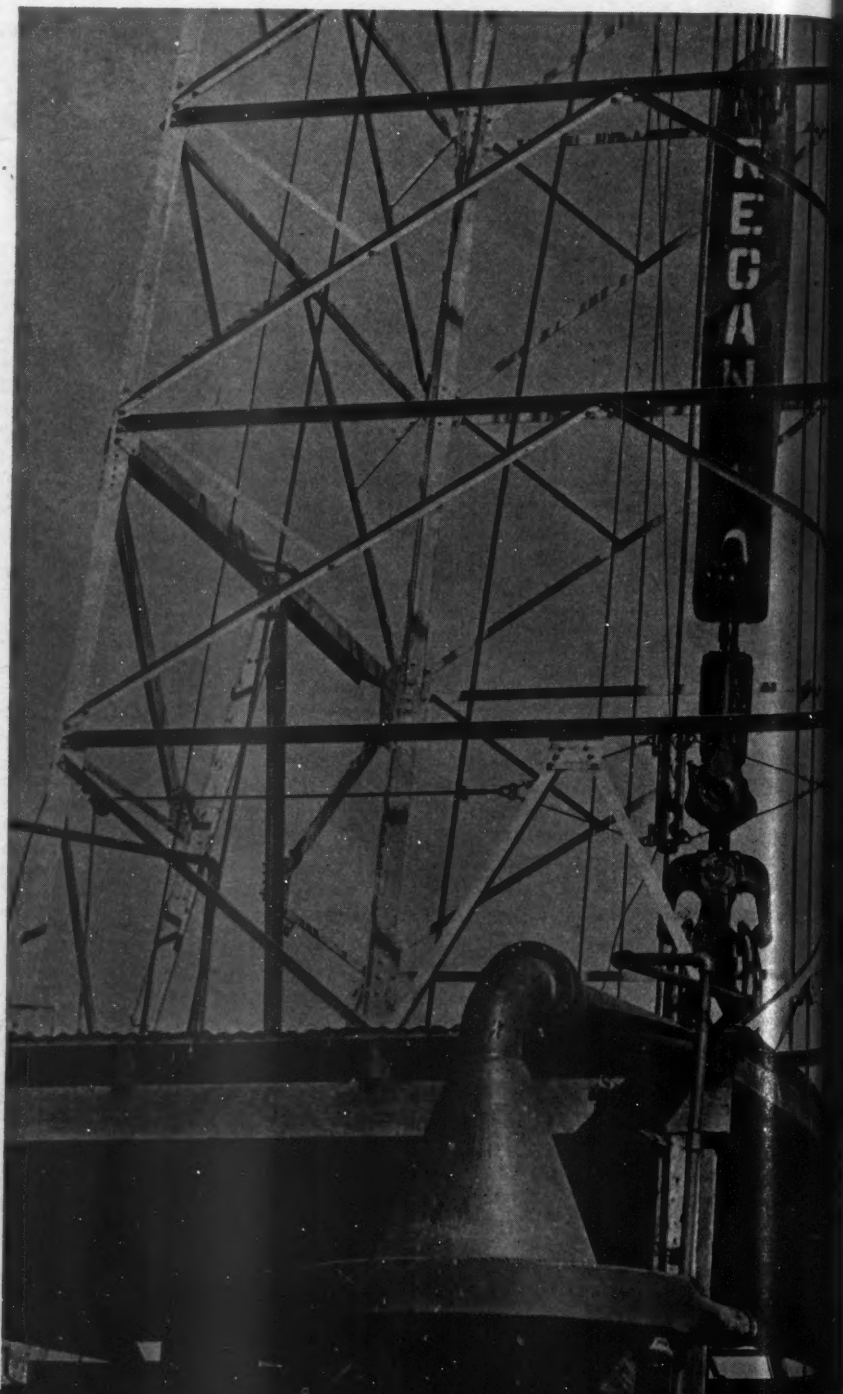
The drilling of deep wells has now become a necessity for the complete exploration and development of many petroleum areas both in California and other parts of the United States and in countries throughout the world. A depth of 15,000 feet has already been reached in California; and, while this depth is not a criterion for present drilling operations, wells to 10,000 feet and below are by no means unusual. Equipment has therefore proved its ability for the drilling of what we now consider deep wells; in fact it has shown its adaptability for going to depths not yet penetrated.

Wallace A. Sawdon, well known writer of petroleum activities in California and South America, introduces in this article a series he has prepared on surface operations and equipment in oil well drilling. Covering in an obviously general fashion the various units of surface equipment, the writer indicates the wide scope of the series of detailed articles which has been prepared for publication in subsequent issues of the California Oil World each month.

An outline of articles which will appear in this engineering series was published in the First and Second issues, January 1940, of the California Oil World.

Because of the number of deep producing fields in California a definite technique for deep drilling has here been developed. The different companies naturally do not use identical drilling procedure nor the same kind of equipment. There is, however, a general similarity of methods applied in a proven field that is being developed although a discovery well may go to depths far greater than were ever contemplated when the well was spudded in. Such wells have probably overloaded equipment to an extent greater than that for which it was designed but the success achieved in such instances reflects most favorably on both the equipment and the operator who, by careful and intelligent operation, meets the problem and solves it. In this article only the surface equipment being used for deep drilling in California is discussed; drilling practices and other equipment will be treated in subsequent articles.

In considering the surface equipment for drilling deep wells it must be remembered that subsurface conditions will influence the stresses put on the equipment. A well of eight or nine thousand feet in one field may cause more wear and tear on equipment than one of twelve thousand feet in another field. The economic factors must

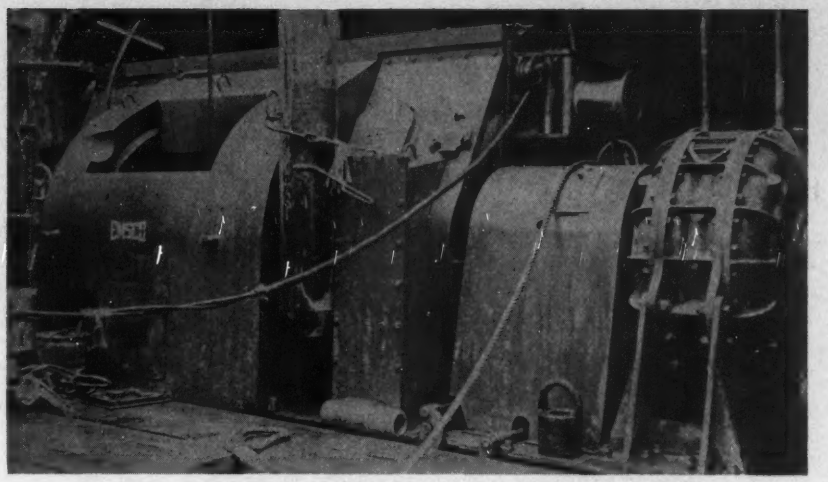


This BJ Triplex 300 hook and Regan travelling block will handle any loads on present deep well operations. Note Vernon desander and Patterson-Ballagh wire line guide.

enter into all calculations. A deep well costs enough under any condition and any equipment that will reduce this cost is well worth considering. Speed is a factor of economy not only from the standpoint of saving on labor costs but also in getting returns on the investment as soon as possible. Modern equipment, when properly selected and used with skill, will undoubtedly aid in getting a fast, straight hole which can be completed most readily and with assurance of the greatest degree of permanency.

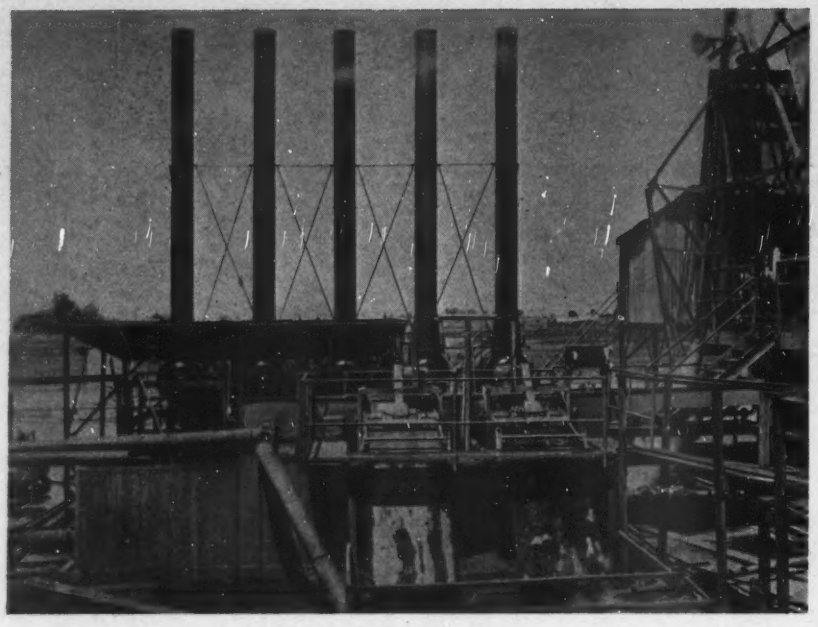
Derricks

The 178-ft. steel derrick with 32-ft. base is widely used for drilling many of the deep fields. The 136-ft. derrick, however, is preferred by some operators but with this height derrick a 30-ft. base has been found advisable. At the present time there seems to be a trend toward the use of the 150-ft. derrick with 32-ft. base since it is felt that this type will provide conveniently for racking the drill pipe required for drilling to depths up to 15,000 ft. and give adequate clearance for traveling equipment at the fourble board. All derricks are constructed with a 400- to 500-ton load capacity in the tower which has evidently



This new Emsco draw works now in service in the San Joaquin Valley has 60-in. brake rims. The hydromatic brake is the double rotor type.

Two LeRoi Gas Engines supply the power here. The Wilson Power Rig is as modern as the latest model airplane.



Note the compact arrangement of the steam generating plant and circulating equipment at this well drilling in the Rio Bravo field. Vibrating screens are installed on the steel suction tank behind which are located the mud pumps. In the background can be seen the battery of five 500-lb. boilers, the largest type ever used for oilfield service.

been sufficient for any duty yet placed on the derrick.

With the 178-ft. derrick drill pipe stands of 120-ft. can be racked although an extra finger has to be provided to give the pipe the necessary support and eliminate the sag. Even with this extra finger drill pipe of size smaller than 4½-in. cannot be racked in 120-ft. stands because of the flexibility of this length stand. In drilling to depths of 10,000 ft. and below, however, it is the practice with many of the companies to use 4½-in. drill pipe for the lower drilling and in such cases the 120-ft. stands are employed throughout drilling operations.

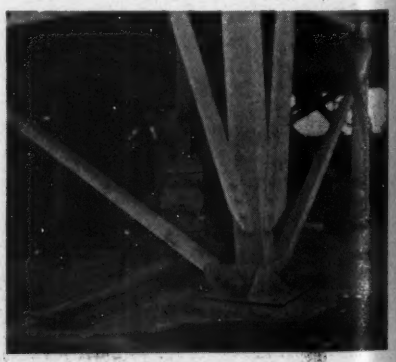
The use of the long stands obviously aims to increase the speed of drilling since it is believed that better time can be made on each round trip. The 32-ft. base gives a further advantage in that it provides more room on the derrick floor for racking the pipe and the handling of the modern large drilling equipment on the derrick floor. A ten to twelve thousand-foot string of 4½-in. drill pipe requires considerable space when it is out of the hole. The larger blocks necessary for handling this string and the casing which is run while the drill pipe is out of the hole require more space.

While the height and base of the 178-ft. derrick have evidently been adequate, it still seems desirable to have more room at the fourble board to provide greater racking area and give more clearance for the travelling block when the 136-ft. derrick is used. One derrick built with a dual taper on all four legs was used on a well at Wasco but was found to have too much room at the fourble and made it difficult for the derrick man to operate. A new design to provide additional racking area is now in service and will no doubt prove advantageous. This derrick is constructed by extending the extended bracing from about the double board to above the fourble and provides additional room for the pipe beyond the derrick legs on one side only. This bracing may be added to any derrick in the field by the manufacturers of the set back extension. The stress distribution in the tower is not changed. The extra racking capacity for pipe will probably be

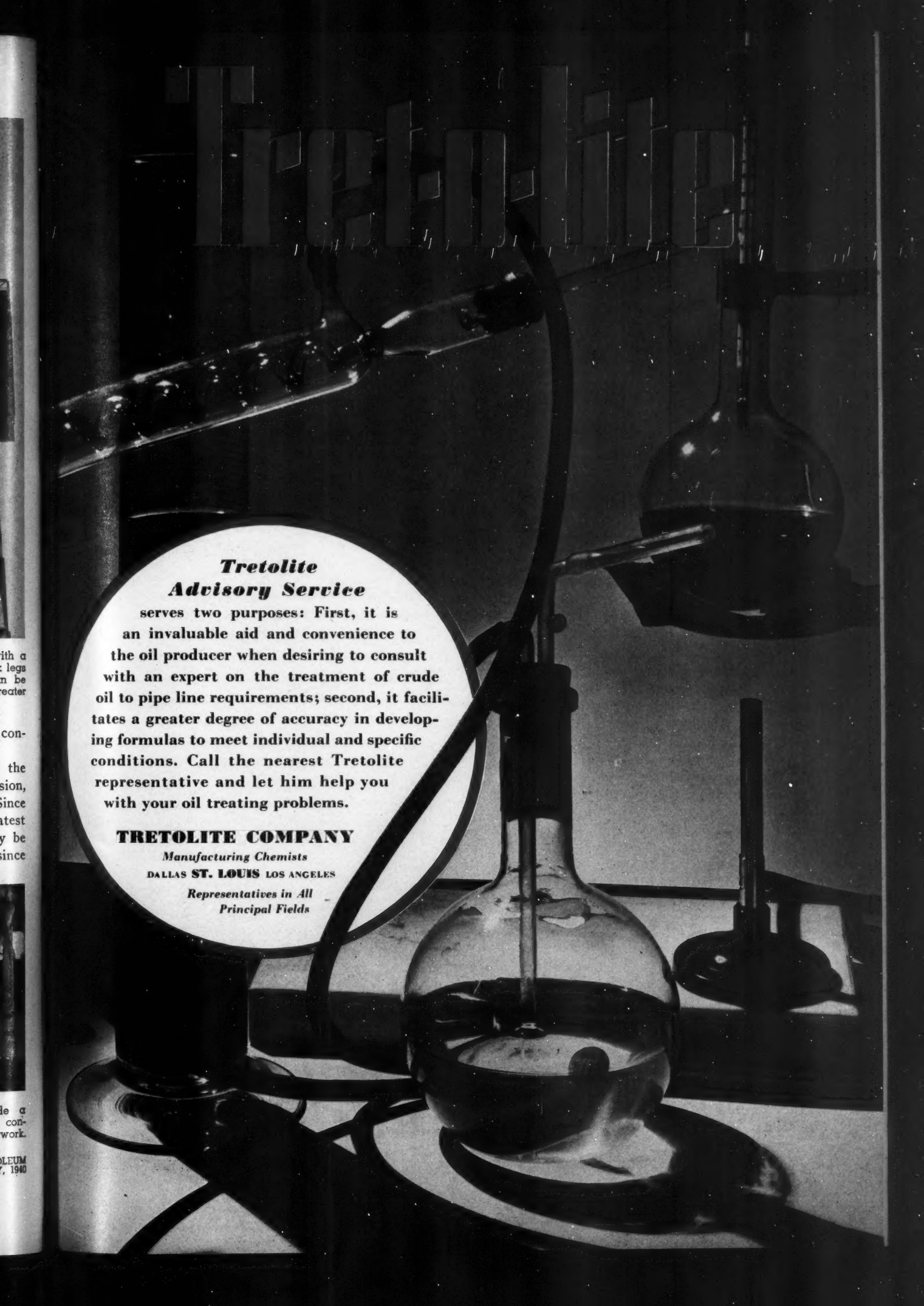
This 136-ft. derrick is constructed with a set back extension outside the derrick legs to above the fourble board, as can be seen on the right. This provides greater racking space for pipe stands.

from ⅓ to ½ of that of the conventional derrick.

With the 150-ft. derrick or the 136-ft. with set back extension, stands of 90-ft. are employed. Since some operators drill the greatest depths with pipe that can only be racked in 90-ft. lengths and since



The extended derrick legs provide a raised derrick floor and increases convenience and safety for underfloor work.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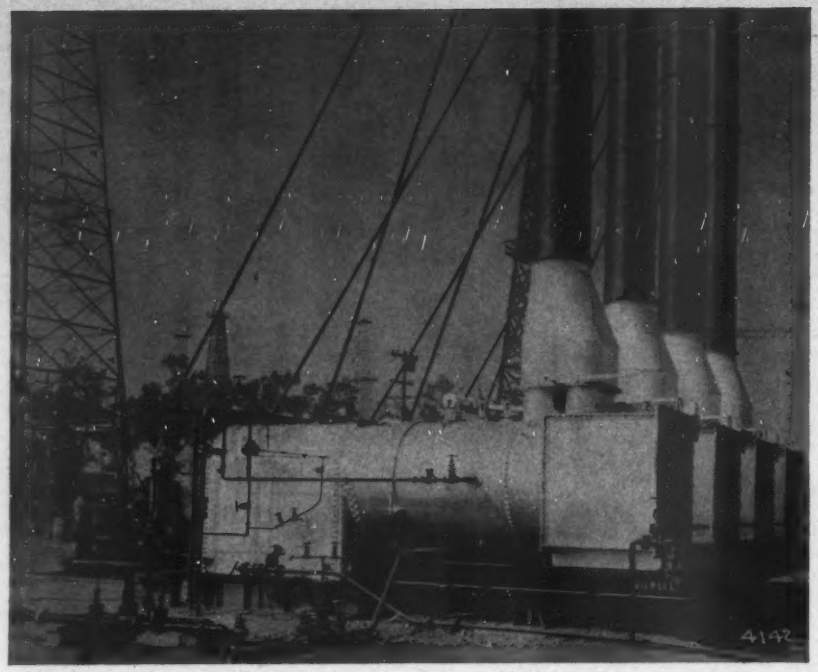


This battery consists of four 350-lb. boilers with superheaters in the smoke box. Built integrally with the boiler, the superheater on this type provides a superheat temperature of 650°F.

round trips at these depths are the ones which take the longest time, the advantages of providing for longer stands with higher derricks are lost.

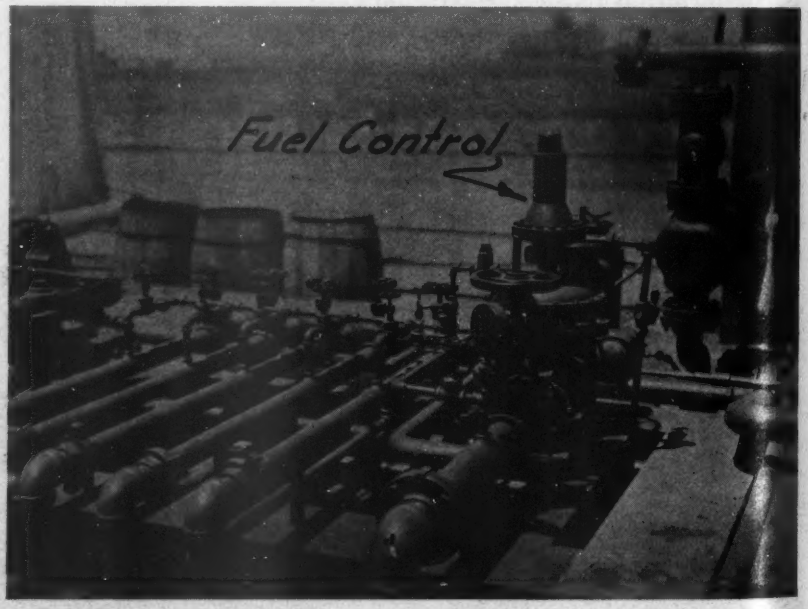
Greater working space on the derrick floor is provided by individual engines for driving the rotary table, especially when the engine is located under the floor. The high derrick floor is now being quite widely used in California and is usually 8-ft. above the ground level although with some wells it has been elevated to 11 feet. The elevated floor is secured by means of extended derrick legs and steel underpinning. The raised floor eliminates the necessity for deep cellars.

Rig Equipment

The 14 x 14 twin cylinder horizontal and the 12 x 12 twin cylinder vertical steam engine have been used to power the draw works on more of the deep wells drilled in California than any other type of prime mover. These engines are operated on 350-lb. steam with the 14x14 developing a little above and the 12 x 12 a little less than 1000 h.p. They have evidently been capable of handling any loads put upon them by the deep drilling operations to date. The largest engine yet to be used was the 15 x 14 twin cylinder steam engine operating on 500-lb. steam with which a number of wells have been drilled in the Rio Bravo field. This engine is exceptional, however, and is probably adaptable for drilling to depths much greater than any contemplated at the present time.

An important factor in the decision to use an individual engine for driving the rotary table is the matter of rotating speed. Table speeds have been increased by many operators in California to such an extent that driving the table by the draw works engine is not practicable. Two types of prime mover are used for this purpose, the horizontal twin cylinder steam engine and the vertical twin cylinder steam engine.

The horizontal type is placed below the derrick floor and drives the rotary machine through a chain drive. At the present time most of the engines applied to this service on deep wells are the 12 x 12 size. The elevated derrick floor provides ample vertical clearance for the engine and allows plenty of room for its operation. The vertical type engine is placed on the derrick floor and is direct connected to the rotary machine. This engine and the rotary table are mounted as a unit on skids and with the 10 x 9 size vertical engine generally used for deep wells the unit extends 15'-4" from the center of the table. The location of this engine is usually opposite the draw works.



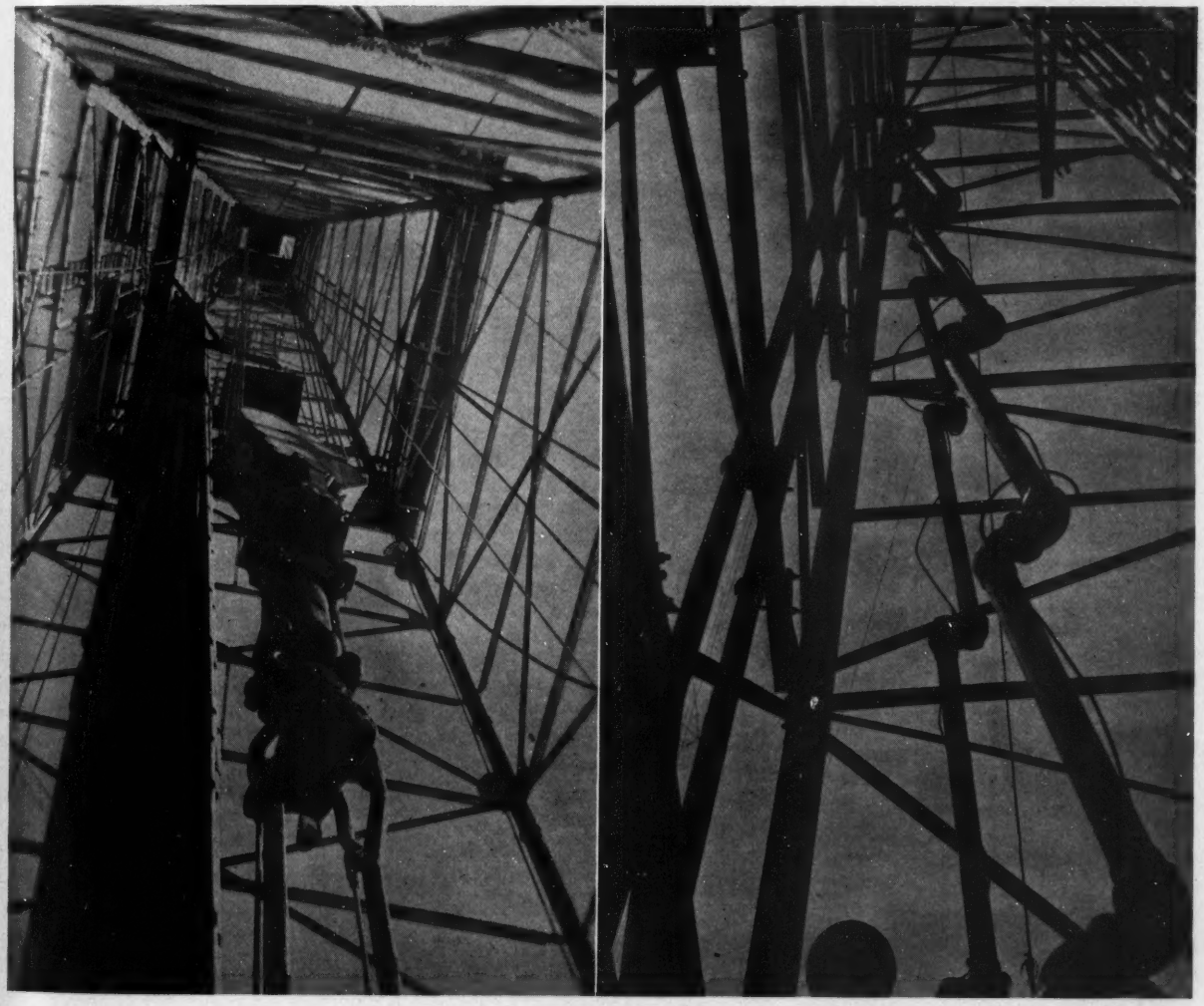
Automatic control of fuel gas provides smooth operation and economy. This N. G. E. control device is mounted on the feed-water manifold unit.

One well has been drilled to below 11,000 ft. with gas engines. While a number of wells during the past few years have been drilled in California with engines using gas or butane as fuel this one is the first of that type which comes under the classification of deep drilling as considered here.

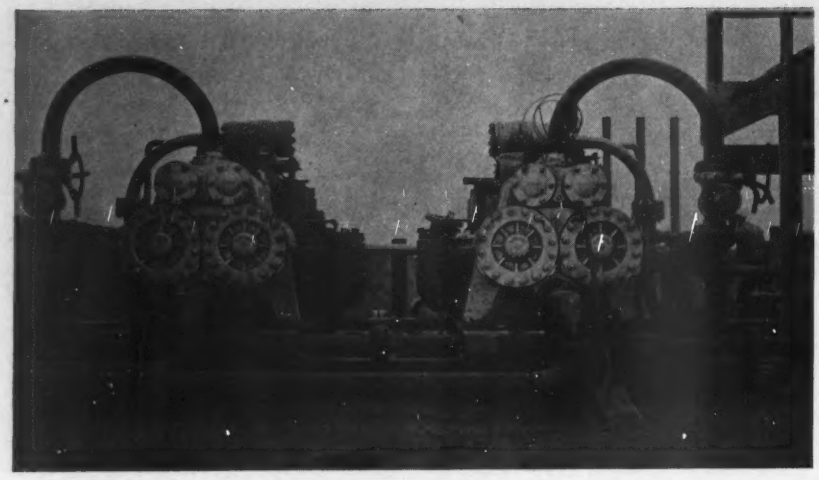
Two 350 h.p., gas engines are used as prime movers in drilling wells to these depths. These engines are combined to drive the draw works, rotary table and two mud pumps. Transmission of power to the draw works is through a chain drive, oil bath transmission. The pumps are usually 7¾" x 20" and are driven by 14 V-belts from the shaft of one of the engines. The load can be split between the engines by clutch when desirable to give flexibility of operation.

While the rotating speeds of rotary machines up to the present time have been rated at a maximum of 350 r.p.m., many of the deep wells in California have been drilled with speeds up to 500 r.p.m. and in exceptional cases with rotation even beyond this. The tables have, however, performed satisfactorily. Actually the tables used for high speed rotation are probably underrated and in some cases are constructed of better metals than shown in their specifications. A table design widely used with underfloor drive has a 20½-in. opening and is constructed with spiral bevel ring gear and pinion. Most of the deep wells drilled with high-speed rotation require the use of no casing larger than can be accommodated through the 20½-in. opening in the table and the use of the smaller tables has probably been influential in their success with high speed. All deep wells in California, however, are not drilled with speeds above the table ratings of 250 to 350 r.p.m. Large tables, such as those with 27½-in. opening, are also used. Probably all types in service on deep wells are totally enclosed with oil-bath lubrication.

The heaviest modern draw works of various makes are employed on most of the deep wells. Until very recently the largest has been of the type used in the Rio Bravo field and driven by a 15 x 14 engine. This particular one is, like others being



Starting out with drill pipe in an 11,000-ft. well. The traveling block is the new Emsco streamlined design which has just been introduced. This 5-in. Chiksan steel rotary hose is an exceptional piece of equipment in that it is the largest hose yet put into service. The standby hose shown is 3-inch.



These Ideal 15½"x9¼"x22" mud pumps are the largest ever built.

used, a totally enclosed draw works of the 3-speed type. The drum shaft diameter is 10½-in. and the line shaft diameter 9 inches. The drum is 28-in. diameter and has a spooling space of 46⅜-in. long which provides a capacity of 4690 ft. of 1¼-in. line. The brake rims are 54-in. in diameter. One double chain is generally used for driving the draw works but in the rig where the prime mover is a 15 x 14 engine two double chains connect the engine and draw works.

The latest design of draw works to be put into service has recently been installed on a well in the San Joaquin Valley. This is probably the largest yet built and has brake rims 60-in. in diameter. This machine is furnished with either 3 or 4 speeds and has multiple jaw clutches. The drum shaft is 10½-in. diameter and line shaft 9 inches. The spooling drum is 34-in. diameter with a spooling space 41 in. long which gives a line capacity of 3490 ft. of 1¼-in. line. The shafts are all made of chrome-nickel alloy.

The draw works powered by gas engines used to drill below 10,000 ft. have six speeds forward and two reverse. Features of this rig are internal-expanding friction clutches that are self-energizing, air-operated and water cooled. All operations are air controlled and give an approximation of steam operation. The drum has 56-in. diameter flanges and with a spooling space of 48-in. has a capacity of 5350 ft. of 1⅛-in. line. Brakes are 54-in. diameter by 10-in. wide and are effective over 90 per cent of the total brake surface. A single hydromatic brake is generally employed in drilling deep test wells.

Hydromatic brakes are generally used on deep well operations. Some companies employ two of these single brakes, one on each end of the draw works. Others use a double rotor hydromatic, on one end only. The arrangement of a single brake on each end is considered by those using two units to give a better balance than the use of one double rotor type on one end as preferred by other operators.

Weight indicators are, of course, used on all wells and most of the wells are equipped with combined instruments showing weight carried on the bit, the rotating speed of the table, the pump pressure and the torque on the drill pipe. With wells drilled with high speed rotation, the tachometer showing the table speed in r.p.m. is particularly necessary. The rotating speed and weight carried on the bit must be controlled carefully if fast, straight hole is to be secured; and straight hole, while now considered a requirement of efficient drilling operations, is especially essential in wells drilled to depths below 10,000 feet.

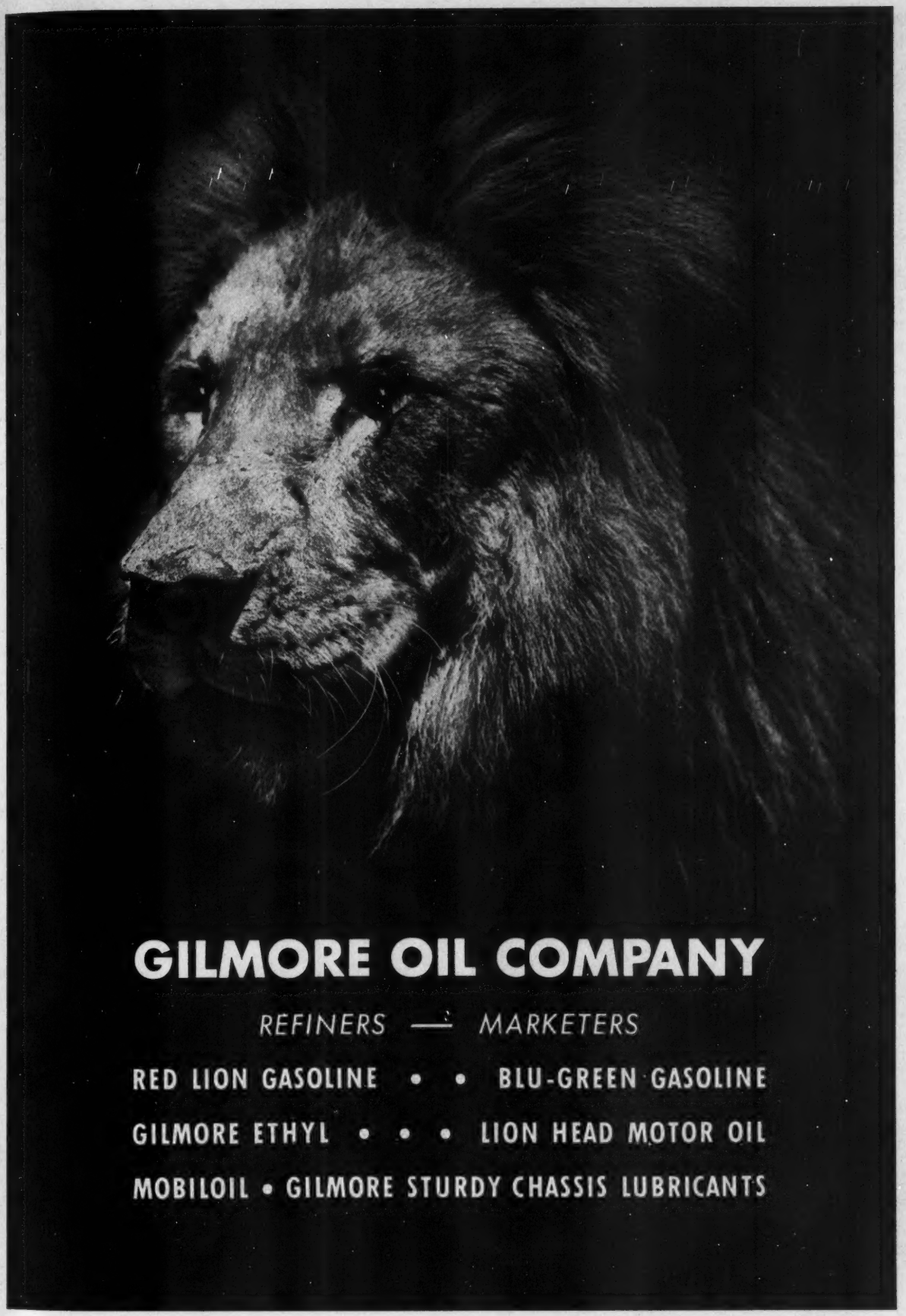
Rotary chains are being designed toward exact precision with close tolerance in all parts. Metallurgy and heat treatment have been improved and accurate grinding is provided. The double 3⅛-in. pitch chain with a tensile strength of 230,000 pounds has become popular for deep drilling operations in California. The weight per foot of 3⅛-in. pitch chain is 24 pounds.

Automatic catheads and catline hoists are almost universal equipment on deep drilling rigs. Tongs of the most modern design are also found on practically every well. Operators consider safety a very important factor and provide equipment with safety features wherever possible. Such features seem to have a definite influence on the efficiency of the drilling crew and reflect, perhaps indirectly, on the success attending the drilling of many of the wells.

Crown and travelling blocks being used for deep wells have ratings up to 500 or 600 tons ultimate; but many having ratings of from 300 to 350 tons with factors of safety of 2 or above will evidently withstand any loads that can be applied to the derrick. The sheaves to accommodate 1¼-in. lines are 46 or 48-in. diameter and are generally six in number for the crown block and five for the travelling block. The sheaves of both the crown and travelling blocks are usually interchangeable.

Due to the restricted clearance caused by the racked drill pipe when a long string is out of the hole, streamlining of the travelling equipment has become an important feature. Manufacturers have taken this into consideration and the latest designs aim to provide the least horizontal space requirements possible.

A new type of crown and travelling block has just been introduced which employs drums in place of shafts. This reduces the sheaves to the character of a rim with large diameter roller bearings. The sheaves are 50-in. diameter in the rope groove. The crown block is provided with either 6 or 7 sheaves and the travelling block with 5 or 6 sheaves. The overall length of the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travelling block is 8'-5" with the width of the 5-sheaves block 24-5/16-in. and the 6-sheave block 28-3/16 inches. The rated capacity of the crown block is 350 tons and that of the travelling block 325 tons but each has a factor of safety of two.

Hooks in use have capacities up to 500 tons; but those of lower ratings have factors of safety so high that the actual safe loads that can be handled are far above the 500-ton capacity of the derrick towers in which they are run. Safety features are given due consideration in the construction of hooks and elevators with latching devices eliminating all hazards possible. The triplex type of hook is widely used. One company uses a "connector" in place of a hook, this device having independent supports for the links.

The swivel rating for deep wells in California must take into consideration rotating speeds as well as the weight of the long strings of heavy drill pipe. The highest speeds to date have probably been made with 5 9/16-in. drill pipe and at depths above 10,000 feet In one well a depth of below 12,000 ft. was drilled with 4½-in. drill pipe at a rotating speed of 300 r.p.m. The largest type of heavy duty swivel is evidently the safest to use under such conditions but those of lighter construction are being used for the drilling of many deep wells since such high speeds are not employed by all the companies and 3½-in. drill pipe is frequently used for the greatest depths. Vibration due to high speed rotation, and big mud volume with high velocity must also be given consideration. Wash pipe fluid passage is usually 4-in. diameter although many of the swivels in use have 3-in. wash pipe. The octagonal kelly is claimed by some operators to decrease vibration with the further advantage of providing larger fluid areas.

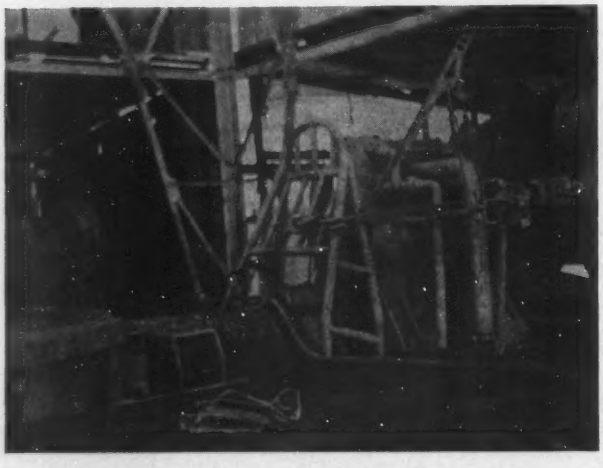
The all-steel rotary hose is widely used and the 4-in. size is employed where fluid volume is large. Only one 5-in. steel hose has been used to date and that by one company circulating with the largest size pumps yet built for oilfield service. The advantage of a large opening through the hose where many bends will tend to cause friction loss and wear is obvious since maximum delivery is made into the drill pipe whose fluid passage is a straight downward opening. A standby, frequently a 3-in. steel or rubber hose, is generally installed in the derrick.

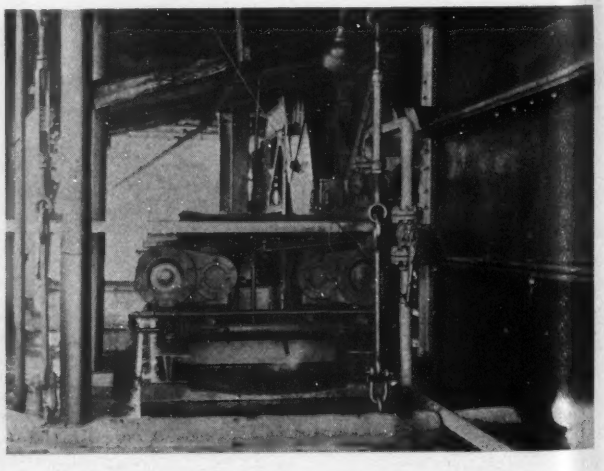
Both 1⅛-in. and 1¼-in. wire line are being used for deep drilling but there appears to be an increased tendency in favor of the 1¼-in. size. The large crown and travelling blocks are equipped with sheaves that handle this size line. On the deeper wells 10 lines are general practice and with the large draw works now in service the spooling capacity is fully adequate for the highest derricks. Wire line guides have aided materially in decreasing the wear on lines. There has been some talk of using 1½-in. line but it is felt that larger sheaves and drum diameters would be necessary to secure effective and economic use of this size line. Lines now in service have been able to handle the loads applied and the introduction of 7-sheave crown blocks with 6-sheave travelling blocks would indicate the possibility of using more lines. More lines make for slower hoisting speed, however, and that will be given due consideration.

Circulating Equipment

Big volume and high pressure are made available for mud fluid circulation at all deep drilling operations and this necessitates the use of large pumps. Both steam and power pumps are employed for this service, the power pumps usually being driven by a steam engine. Steam pumps range in size up to 18" x 8" x 20" and the power pumps to 7" x 20" driven by a 10" x 9" vertical twin cylinder steam engine. These all operate with 350-lb. steam. An exception is the pump installation which has been used for a number of wells at Rio Bravo and which has consisted of two 15½" x 9¼" x 22" steam pumps using 500-lb. steam. These are the largest pumps yet built for oilfield service.

Two pumps are generally used for circulation. These are com-





The Oilwell vertical steam engine direct-connected to the rotary table is placed on the derrick floor for individual rotary drive. This 12"x12" Ideal-Ajax twin cylinder steam engine is typical of the underfloor drive for rotary table.

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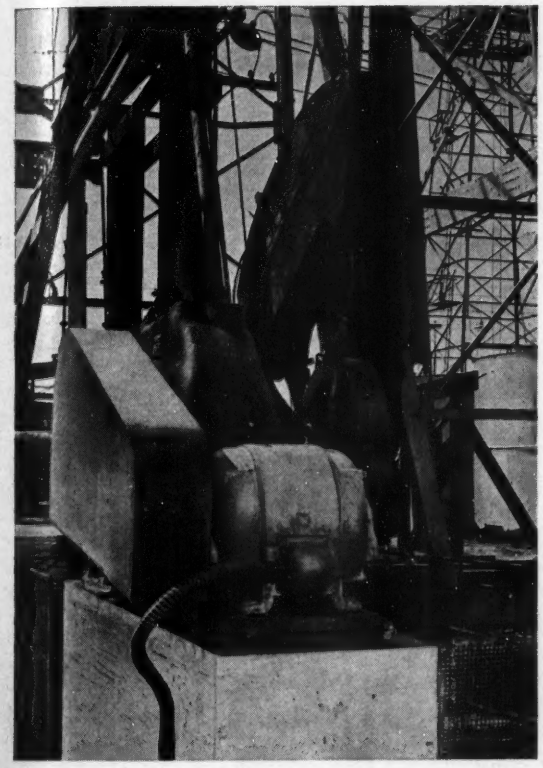

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pounded when high pressures make it necessary and a line blind placed in the suction line of one pump facilitates compounding. Due to the capacity of the pumps now in service, compounding is usually not necessary for much of the straight drilling operations. In some cases where the operator wants rapid displacement of slurry while cementing a long string of casing, the circulation pumps are applied to this service. The pumps are then run in parallel to give maximum volume unless the pressure required makes compounding necessary.

A third pump is generally used for mixing the mud with weight material, thinning agent or other admixture and pumping the prepared fluid to storage. This pump is of a size up to 15½" x 6¾" x 14" or even 14½" x 7½" x 18" and is powered by 350-lb. steam. Many companies install a steel mud storage tank near the rig and keep conditioned fluid in this tank for replacement of spent fluid. In some fields a degasser is built for conditioning the mud. Although the smaller pump is generally used for taking care of the mud supply and for pumping over the degasser, it is frequently the practice to use one of the circulating pumps on this service during the time that two pumps are not required for circulation.

Steel suction pits as well as steel ditches have come into more general use with the elevated derrick floor. The suction line of the pump is connected to the bottom of the tank and a head of a few feet is maintained on the suction inlet. Two vibrating screens are almost always installed for deep drilling operations.

Steam Generating Plants

Superheated steam is almost universally used on deep well operations, the superheat temperature running as high as 650° F. At most of the wells the superheaters are built integrally with the boilers although some operators prefer a separately fired superheater for the boiler battery.

Batteries consist generally of four 125 h.p., 350-lb. boilers although five boilers have been used in the 500-lb. steam installation in the Rio Bravo field. This 500-lb. steam installation, however, is exceptional and while four boilers would have been adequate for all drilling operations, the extra boiler was used to test the efficiency of the steam generating plant and the big pumps with a view toward determining its adaptability to more difficult jobs when such jobs become necessary.

Most boilers (and individual superheaters when they are used) are skid-mounted to facilitate transportation and setting up. Central steam generating plants have been installed in some fields where company holdings are of an extent that permit the boiler plant to be located so that it will serve for the drilling of more than one well. At Rio Bravo one company placed steam generating plants to serve four wells each; at Wasco another company has installed a central plant for a number of wells.

Boiler feed-water installations have been unitized with feed-water pumps, pipe manifold systems and turbo generators mounted on the one base. This unit is readily set up and connections made with the least amount of time and labor. Fuel to boilers is frequently automatically controlled by pressure through a line from the main steam header, the control device being installed with the manifold system on the feed-water unit. Low-pressure, draft-controlled burners are widely used and air into the burners is regulated by a regulator on each boiler. The entire operation of the boilers is thus automatically controlled during the drilling of a well to provide consistent maintenance of steam pressure and a resulting conservation of fuel and water. Most feed water in California requires treating and equipment for treatment is installed near the feed-water pumps.

You are reading the Pacific Coast oil men's home paper.

Minimum Economy In Drilling Operations

Modern power drilling rigs have a very definite place in present day drilling operations. Their chief assets are portability and economy. Manufacturers are constantly improving these rigs and at this time there are several power rigs on the market that will and do make hole just as fast as comparable steam or electric rigs and at considerable saving in expense. One manufacturer even has guaranteed his rig for 15,000 feet drilling in direct competition with steam rigs.

In wildcat drilling, where fuel and water have to be hauled or long pipe lines laid, this type of rig will save thousands of dollars for the operator and give him the same performance as similar steam equipment.

The Sunset Oil Company drilled its Kirkpatrick well in Signal Hill to a depth of 3160' in 124 hours elapsed time from spudding, or an average of 25.5 feet for each hour. Actual drilling and coring time was 84 hours, or an average of 37.6 feet per hour. Twenty-nine cores were taken, or a total of 262 feet were cored. The well was drilled, completed and pumping equipment installed and the well put on the pump in 11 days elapsed time. The rig used was a Wilson Atlas, powered with two L.S.U. Waukesha gas Butane engines developing approximately 235 H.P. each. The two engines were compounded at all times and operated the draw-works and a 7¼x18" Wilson Snyder Power Pump. A 7¼x14" power pump, driven by a G.A.K. Waukesha motor, was used as a stand-by pump and for mixing and shipping mud. A utility unit, consisting of a 7½ K.W. generator driven by a 25 H.P. Buda engine, furnished electricity for lights and sand shakers.

Drill stem consisted of 5" full hole welded drill pipe with four 8½" O.D. drill collars. Rotary table speed used was from 170 to 250 R.P.M. From 4 to 6 points of weight were used on the bit and the inclination of the hole at no time exceeded 50 minutes.

The fuel consumption for all engines averaged about 50,000 cubic feet of gas per day or approximately 400 gallons of Butane per day. The total fuel cost per day, when dry gas is used, amounts to approximately $2.50 to $5.00 per day, depending on the locality. This is less than what is generally paid a fireman for each 8 hours' work at a boiler plant.

A rig of this type can be moved from one location to another and a well spudded in approximately 30 hours.

This type of rig was used by Sunset Oil Company and Kern Drilling Company at Montebello.

The General Utility of the Kremser Factor

A Ten-Year Development

C. N. G. A. Meeting
February

By Randal Maass

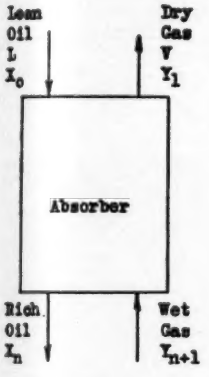
Just 10 years ago this month Mr. Kremser of the Standard Oil Company presented a paper before the California Natural Gasoline Association entitled "Theoretical Analysis, the Key to Absorption Plant Design."[1] In this paper, still considered the most important ever presented before the association, Mr. Kremser introduced the new absorption factor concept and illustrated its use in the control and design of absorption towers. It is appropriate on this the tenth anniversary of that historic event to discuss the general use of the absorption factor and review its extended applications. Although Mr. Kremser restricted his discussion to gas absorbers, other investigators have extended the use of the absorption factor to such an extent that the original ambitious title has been justified. Today we can truly say that "theoretical analysis is the key to absorption plant design," using the term "absorption plant" in its broadest form to include the stabilizing unit.

Although most of you are familiar with the absorption factor equation, many of you may have forgotten the original form in which it was presented. For the benefit of the latter I have prepared Figure No. 1. In an absorber, gasoline constituents, by virtue of partial pressure differences, are transferred from the gas to the oil. Mr. Kremser pictures this transfer as taking place on a series of ideally perfect plates on each of which the oil and gas have attained a state of equilibrium dependent upon the prevailing temperature and pressure. By means of this concept he has been able to show that the concentration (Y_1) of any one component in the dry gas represents the sum of two terms. The first term is a function of the concentration of that component in the wet gas, the new absorption factor and the number of theoretically perfect plates. It represents the concentration of the dry gas when using a **perfectly** stripped oil. The second term is a function of the concentration of the component in a gas in equilibrium with the lean oil, the absorption factor, and the number of theoretical plates. It represents the increase in dry gas content due to the use of an **imperfectly** stripped oil. The absorption factor is the new concept introduced by Mr. Kremser; it is seen to be a function of the oil to gas ratio, the absorber pressure, the vapor of the component in question at the absorber temperature, and the density and molecular weight of the oil. In his paper, Mr. Kremser published curves for the solution of the complicated looking functions of the absorption factor. Note that if the degree of absorption is increased sufficiently, that is, if the absorption factor is increased sufficiently, the first term will approach zero whereas the second term approaches "Y_o" or the concentration of the component in a gas in equilibrium with the lean oil. In other words, no matter how good your absorption process may be the concentration of any component in the dry gas can never be reduced below its concentration in a gas in equilibrium with the lean oil at the absorber temperature.

Before further analyzing the absorption factor and the absorption factor equation let us examine the revision of this equation as published by Souders and Brown[2]. The term on the left in Figure No. 1 represents the actual change in concentration divided by the total possible change and is approximately equal to the percentage of the constituent absorbed. That is, the numerator is equal to the difference between the component's concentration in the wet gas and its concentration in the dry gas, whereas the denominator is equal to the difference between the component's concentration in the wet gas and its concentration in the limiting dry gas or the gas in equilibrium with the lean oil at the top plate temperature. Dr. Brown expresses concentrations as molal concentrations; however, the term is dimensionless and any consistent set of concentration units may be used. The term on the right is a function of only the absorption factor and the number of theoretical plates, and its solution may be obtained from a set of curves published in the paper.

Both of these forms of the absorption factor equation have their advantages.

FIGURE # 1



Kremser's Absorption Factor Equation

$$Y_1 = Y_{n+1}\frac{A-1}{A^{n+1}-1} + Y_o\frac{A^{n+1}-A}{A^{n+1}-1}$$

$$A = \text{Absorption Factor} = \frac{3.156\ DTO}{MpC}$$

Brown Revision of Absorption Factor Equation

$$\frac{Y_{n+1}-Y_1}{Y_{n+1}-Y_o} = \frac{A^{n+1}-A}{A^{n+1}-1} = \phi\,(A, n)$$

$$A = \frac{L}{KV} = \frac{3.156\ D}{MK}\frac{O}{G}$$

Y_1 = concentration of any one component in the dry gas

Y_{n+1} = " " same " " " wet "

Y_o = " " " " " a gas in equilibrium with the lean oil at the absorber temperature

D = density of lean oil at standard conditions

M = molecular weight of the lean oil

T = Absolute absorber pressure

P = vapor pressure of component at the absorber temperature

O/G = gallons of lean oil per M.c.f. of gas

n = number of theoretical plates

L = mols of oil; V = mols of gas; K = Y/X = Equil. const. @ absorber temp. and press.

X_o = concentration of component in lean oil

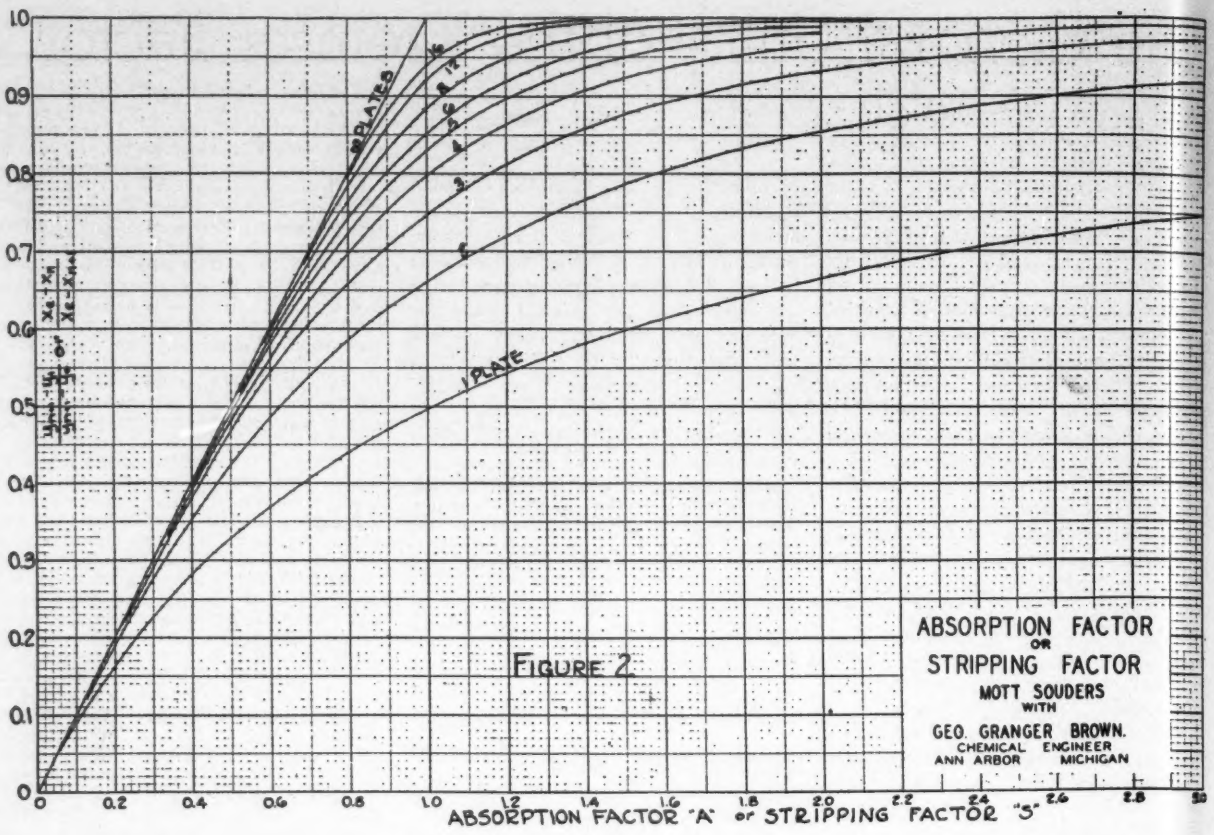
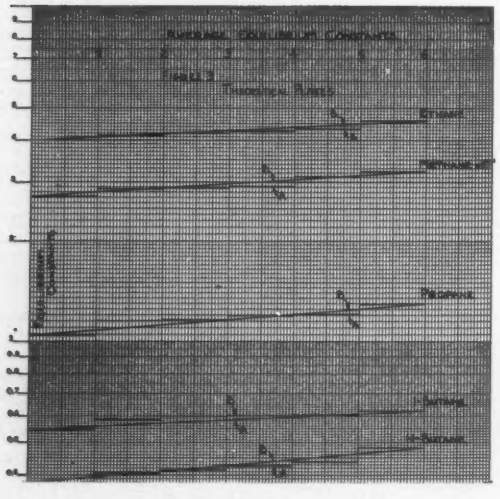
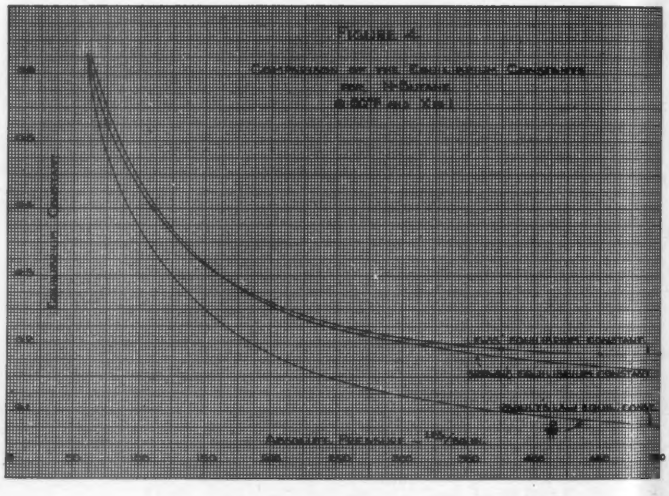


FIGURE 2



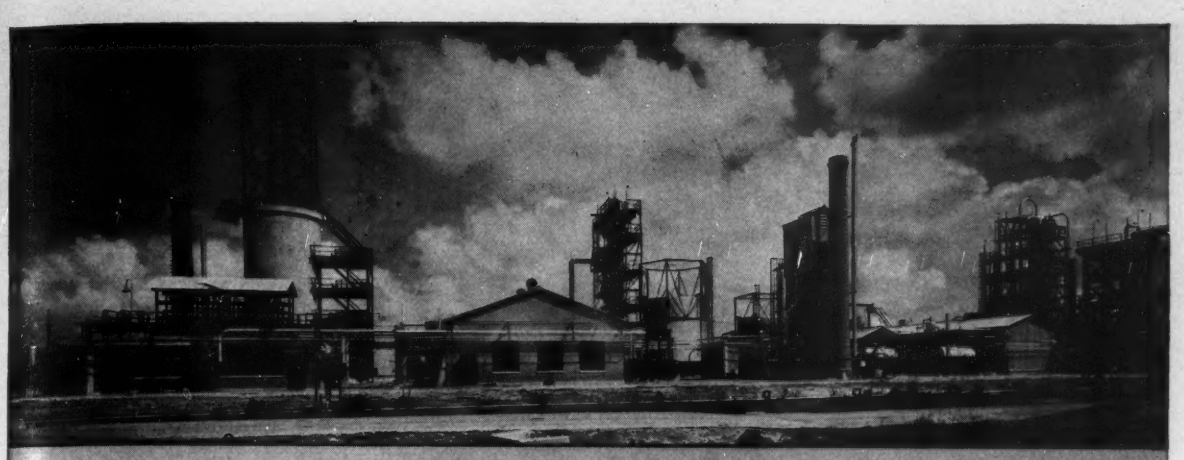


Mr. Kremser's equation has the advantage of separating the effect on the dry gas of poor absorption and the effect of poor stripping. In the equation published by Brown and Souders, the concentrations have all been grouped into one term and the absorption factor together with the number of plates into another term. This form requires but one set of curves for its solution. I hope those who favor the form presented by Mr. Kremser will forgive me if I seem to favor the revised form. After all the form of the equation is not nearly so significant as the equation itself.

Since I plan to use the revised form in this presentation, I have included a graph (Figure No. 2) of the curves for its solution at this time. The abscissa, as you can see, is in terms of the absorption factor, and the parameter in terms of the number of theoretical plates. The ordinate gives the solution of the equation and is equal to the left hand member or approximately equal to the fraction absorbed.

Derivation of Absorption Factor Equation

In the derivation of the absorption factor equation both Mr. Kremser and Dr. Brown and his associates have made several rigid assumptions. First, that there is a negligible increase in the quantity of liquid as it passes down the tower; second, that there is a negligible increase in the quantity of gas as it passes up the tower; and third, that there is negligible change in temperature throughout the tower. To rigidly com-



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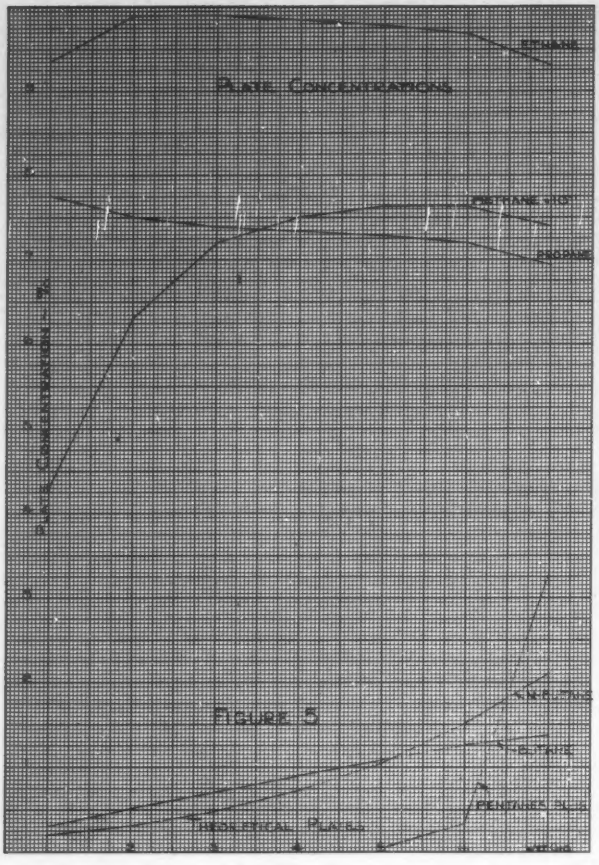


FIGURE 5

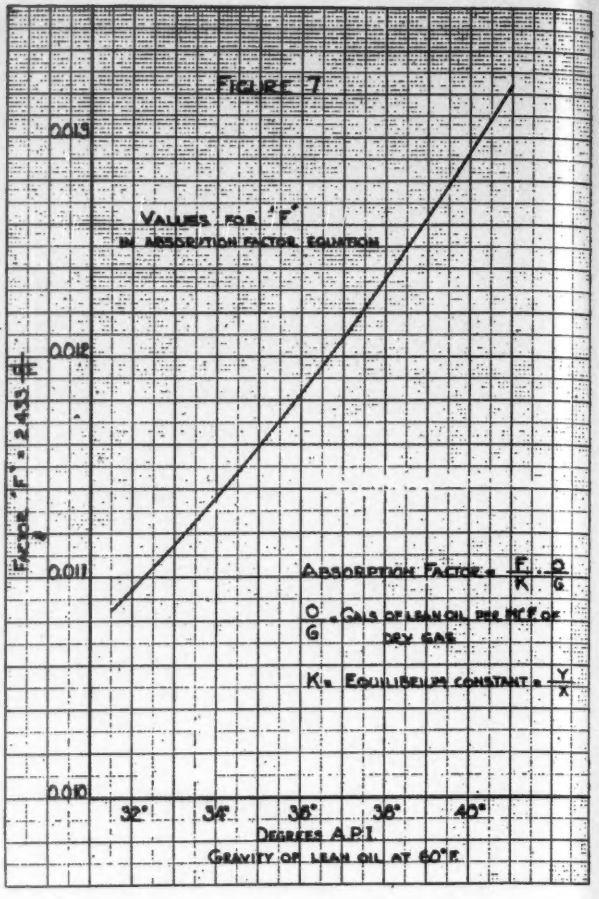
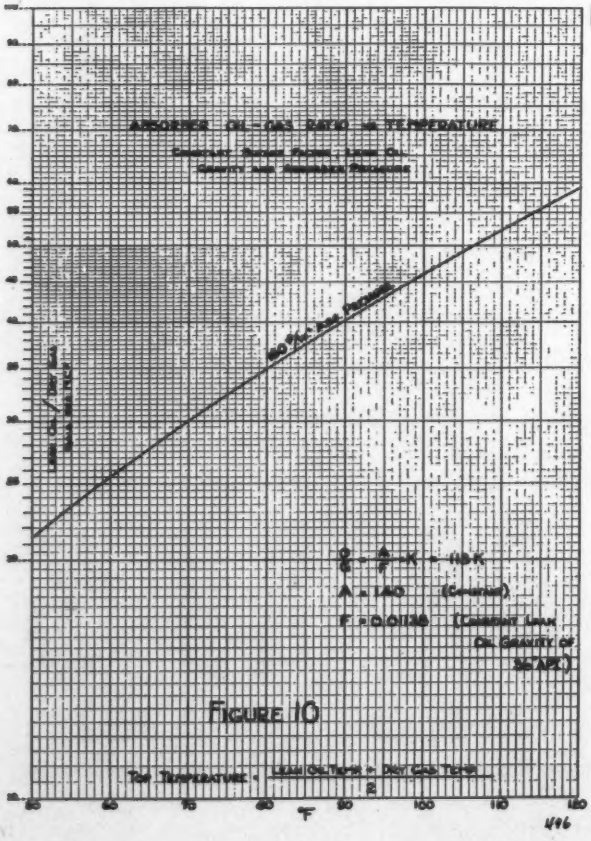


FIGURE 7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Gravity and Absorption Factor Line
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Gals. / M.C.F.
O/G = A/F = K = 140 K
A = 140 (Constant)
F = 0.01130 (Constant Lean Oil Gravity of 36° A.P.I.)
Gas Temperature = Lean Oil Temp. = Dew Point Gas Temp.
°F
446

FIGURE 10

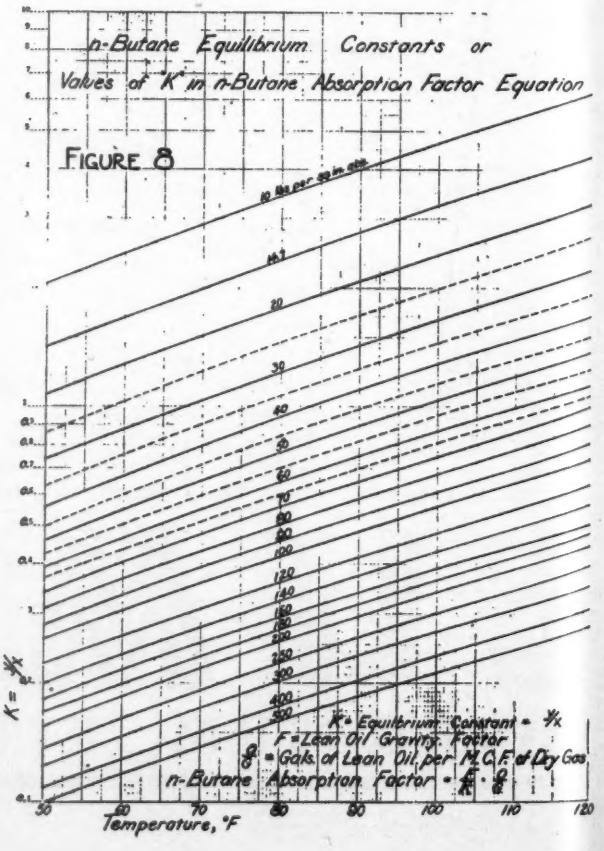


FIGURE 8

ply with these assumptions the gas treated must be very dry. In addition the third assumption may be very much in error in high pressure absorption because a relatively small quantity of oil must absorb the heat of absorption. In the following derivation of the absorption equation, conducted along the lines suggested by Mr. Kremser, the above three assumptions have been omitted to illustrate that these rigid assumptions are unnecessary.

The derivation may be begun by striking material balances for any one component over the first plate from the top and succeeding plates as follows:

1st plate: $(L+a_1)X_1 - LX_0 = (V+a_1)Y_2 - VY_1$

2nd plate: $(L+a_1+a_2)X_2 - (L+a_1)X_1 = (V+a_1+a_2)Y_3 - (V+a_1)Y_2$

.....

.....

nth plate: $(L+a_1+a_2+ - - +a_n)X_n - (L+a_1+a_2+ - - +a_{n-1})X_{n-1} = (V+a_1+a_2+ - - +a_n)Y_{n+1} - (V+a_1+a_2+ - - +a_{n-1})Y_n$

L = mols of lean oil
V = mols of dry gas
X = liquid molal concentration of component under consideration
Y = gaseous molal concentration of component under consideration
a = total mols of material transferred on one plate
subscripts refer to the plates numbered from the top
n = number of theoretical plates

Considering the balance over the second plate; divide the equation by $(V+a_1+a_2)$

$$\text{2nd plate: } \frac{L}{V}(X_2-X_1) = (Y_3-Y_2) + \frac{(a_1+a_2)}{V+a_1+a_2}\left[\frac{L}{V}(X_2-X_1) - (Y_3-Y_2)\right] + \frac{1}{V+a_1+a_2}\left[(a_1+a_2)Y_3 - (a_1+a_2)Y_2 + a_1X_1 - a_1Y_2\right]$$

The result of this division is the simplified plate balance plus a rather imposing residue. A glance at the term in the large brackets will show that it is effectively equal to zero by virtue of the near quality of the simplified plate balance. The remaining residue, although small, will not be neglected.

Defining an equilibrium constant "K" as equal to the molal ratio of the gaseous and liquid concentrations (Y/X), X_2 may be replaced by Y_2/K_2 and X_1 by Y_1/K_1, where K_2 and K_1 are the equilibrium constants applicable at the conditions existent on the second and first plates respectively. With these substitutions the balance for the second plate becomes:

$$\text{2nd plate: } \frac{L}{VK_2}(Y_2-Y_1) = Y_3 - Y_2 + R_2$$

$$\text{where } R_2 = \frac{1}{V+a_1+a_2}\left[(a_1+a_2)Y_3 - (a_1+a_2)X_2 + a_1X_1 - a_1Y_2\right] + \frac{K_2-K_1}{K_1xK_2}\frac{L}{V}Y_1$$

By similar considerations the balances over the successive plates become:

$$\text{1st plate: } \frac{L}{VK_1}(Y_1-Y_0) = Y_2 - Y_1 + R_1$$

$$\text{2nd plate: } \frac{L}{VK_2}(Y_2-Y_1) = Y_3 - Y_1 + R_2$$

.....

.....

$$\text{nth plate: } \frac{L}{VKn}(Y_n-Y_{n-1}) = Y_{n+1} - Y_n + R_n$$

These equations may be combined to give:

$$\left(\frac{L}{V}\right)^n \frac{1}{K_1K_2\ldots K_n}(Y_1-Y_0) = Y_{n+1} - Y_n + R'$$

The residue term, R′, is the result of the algebraic combination of the other small residue terms.

At this point we may define an average equilibrium constant as follows:

$$K_a = \sqrt[n]{K_1K_2K_3\ldots K_n}$$

Then defining $A = \frac{L}{K_aV}$, the equation becomes

$$A^n(Y_1-Y_0) = Y_{n+1} - Y_n + R'$$

This equation relates the concentration in wet gas (Y_{n+1}) of the component under consideration, its concentration in the dry gas (Y_1), its concentration in a gas in equilibrium with the lean oil at the top plate temperature (Y_0), and its concentration in a gas in equilibrium with the rich oil (Y_n). Since it is inconvenient to evaluate the concentration Y_n, this factor is eliminated by combining the above equation with the following material balance over the whole tower.

$$(L+\Sigma a)X_n - LX_0 = (V+\Sigma a)Y_{n+1} - VY^1$$

or

$$\frac{L}{VK_a}(Y_n-Y_0) = Y_{n+1} - Y_1 + R_T$$

Combing the two equations as indicated we obtain:

$$Y_1 = Y_{n+1}\frac{A-1}{A^{n+1}-1} + Y_0\frac{A^{n+1}-A}{A^{n+1}-1} + \frac{AR'-R_T}{A^{n+1}-1}$$

The last term, or residue term, may be divided into two errors; first the error (E_{K_a}) due to the use in each plate balance of one equilibrium constant and due to the use of the average equilibrium constant in the overall balance; second the error (E_R) due to the general use of the liquid to gas ratio prevailing at the top of the tower.

The first error (E_{K_a}) from the following equation appears to be relatively small since the negative term is somewhat larger than the others. The extent of this cancellation will be illustrated for a particular case in a later portion of the paper.

$$E_{K_a} = \left[A^n\frac{(K_2-K_1}{K_1}Y_1 + A^{n-1}\frac{(K_3-K_2)}{K_2}Y_3 + \ldots + A\frac{(K_n-K_{n+1})}{K_{n+1}}Y_{n+1} - A\frac{(K_n-K_a)}{K_n}Y_n + A\frac{(K_a-K_1)}{K_1}Y_0\right]\frac{1}{A^{n+1}-1}$$

Note that although the term

$$\frac{1}{A^{n+1}-1}$$

approaches infinity as A approaches one the error does not become infinitely large because the term in the bracket approaches zero at the same time. Consequently, at the point $A=1$ the expression becomes indeterminate. At this point, however, the error will be equal to derivative of the numerator divided by the derivative of the denominator, or all the power terms will be replaced by their exponents.

The second error (E_R) may be shown to be equal to the following:

$$E_R = \frac{(A-1)}{(A^{n+1}-1)}\frac{1}{L}\left(Y_1\left[A^{n-1}a_1 + A^{n-2}(a_1+a_2) + \ldots(a_1+a_2+\ldots a_n)\right] + \left(\frac{L}{V}-1\right)\left[A^{n-1}a_1Y_2 + A^{n-2}(a_1+a_2)Y_3 + \ldots(a_1a_2+\ldots a_n)Y_{n+1}\right]\right)$$

FIGURE No. 9
Operating Conditions

Dry gas rate	13,000 M.c.f./day
Lean oil rate	350,000 gals./day
Absorber pressure (top)	145#/in² gauge or 160#/in² absolute
Lean oil temperature	60°F.
Dry gas temperature	66°F.
Lean oil gravity	36° A.P.I.

Computation

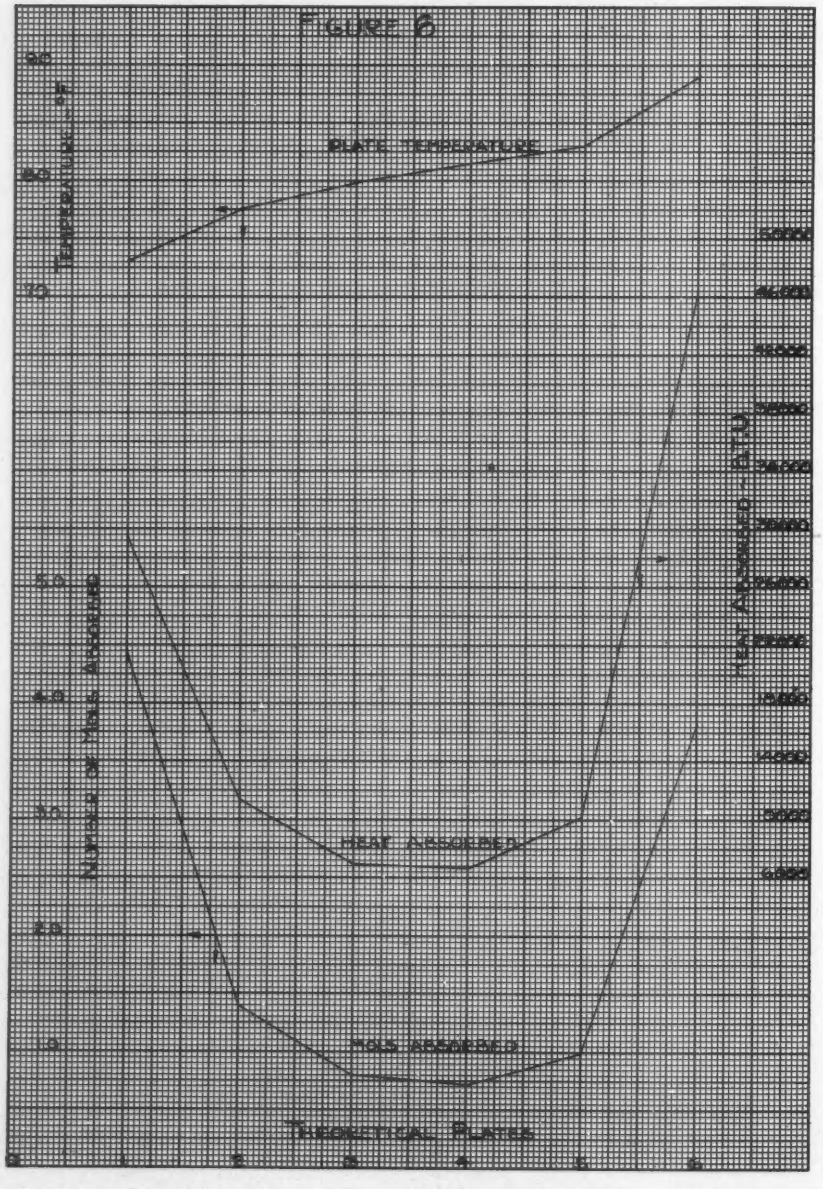
(1) O/G ..... 350,000/13,000 = 26.9 gals./M.c.f.

(2) F ..... 0.01183 from Slide #3

(3) K ..... 0.227 from Slide #4

av. top temp. = 63°F.
top press. = 160#/in²

$$\text{N-butane Absorption Factor} = \frac{F\,(O/G)}{K} = \frac{0.01183 \times 26.9}{0.227} = 1.40$$



When A approaches one, the term

$$\frac{(A-1)}{(A^{n+1}-1)} \text{ approaches } \frac{1}{n+1}$$

This error is also evaluated for a particular case in a later section. Note that these errors are errors in the dry gas content or in other words additions or subtractions to the dry gas content as calculated by the simplified absorption equation. Note also that these errors may have opposite signs and thus help to cancel each other.

If both these errors are considered negligible, the equation assumes the following form.

$$Y_1 = Y_{n+1}\frac{A-1}{A^{n+1}-1} + Y_o\frac{A^{n+1}-A}{A^{n+1}-1}$$

This form of the equation is identical with that published by Mr. Kremser. The substraction of

"Y_{n+1}"

from both sides of the equation and subsequent rearrangement will produce the following equation identical with the form published by Dr. Brown and his associates.

$$\frac{Y_{n+1}-Y_1}{Y_{n+1}-Y_o} = \frac{A^{n+1}-A}{A^{n+1}-1}$$

Several conclusions may be drawn from this derivation. First, the rigid assumptions of constant liquid and gas volumes throughout the tower are unnecessary. We will show later that the error involved in the use of the simplified equation is small if the liquid to gas ratio does not vary excessively throughout the tower. This ratio is fairly constant for the moderately rich gases usually treated at the absorber after compression and the removal of the compression condensate. Its variation, however, will undoubtedly be fairly large in the vapor absorber, or so-called re-absorber, handling the rich, relatively non-condensable plant vapors; nevertheless this assumption is more applicable than the previous more rigid one. We may conclude then that the simplified absorption factor, in either of its two forms, may more generally and with more assurety be applied to our absorption processes since the rigid assumptions are no longer necessary. A practical significance of our conclusions is that the lean oil to dry gas ratio, since it represents the liquid to gas ratio not only at the top of the tower but also throughout the tower, should be used in evaluating the absorption factor rather than the lean oil to wet gas ratio as recommended by some authors. The latter ratio does not exist on any tray in the tower.

This derivation has also shown us that an average equilibrium constant may be

employed with little error in evaluating the absorption factor. This average constant has been defined as the nth root of the product of the n equilibrium constants applicable to each of the n equilibrium plates or:

$$K_a = \sqrt[n]{K_1 K_2 K_3 \ldots K_n}$$

In actual practice it would be difficult to estimate or measure the temperature gradient in the tower needed to evaluate the average equilibrium constant. We can, however, employ a mathematical trick to simplify this evaluation for us. Taking the logarithm of both sides of the above equation:

$$\ln K_a = \frac{1}{n}(\ln K_1 + \ln K_2 + \ln K_3 + \ldots \ln K_n)$$

If the logarithm of the individual equilibrium constants is plotted versus the tray position as in Figure No. 3, the area under the curve (Curve A) will give the term in the brackets. If the extreme ordinates of the curve are connected with a straight line (Line B) and the area under this line compared with the area under the original curve it is evident that the difference is small. Neglecting this difference the area under the curve is

$$\frac{(\ln K_1 + \ln K_n)\, n}{2}$$

Substituting this area in the above equation for the term in the brackets we have:

$$\ln K_a = \frac{1}{2}(\ln K_1 + \ln K_n) \text{ or } K_a = \sqrt{K_1 K_n}$$

That is, the average equilibrium constant may appropriately be evaluated as the geometric mean of the equilibrium constants at the top and bottom of the tower. It is customary to average the temperature of the two streams to obtain the temperature at each end.

Comparison of Two Methods of Calculating the Absorption Factor

Returning again to Figure No. 1 we see that Dr. Brown shows the absorption factor as being equal to the molal ratio of liquid to gas divided by an equilibrium constant "K". For convenience in calculation he has separated the molal ratio into the familiar oil to gas ratio in terms of gallons per m.c.f. and a conversion factor which includes the density of the oil at 60°F, the molecular weight of the oil, and a numerical constant. This second form of the absorption factor is identical with that published by Mr. Kremser with the exception that Dr. Brown has replaced the $\pm/p$ term in the equation by a $1/K$ term. Mr. Kremser has obtained his equilibrium constant by means of Raoult's Law, which says

$$y\,\pi = px \text{ or } y/x = p/\pi = K'$$

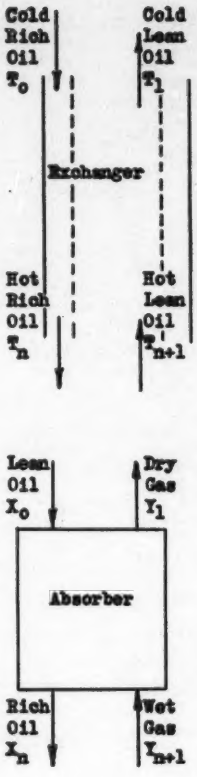
Dr. Brown, on the other hand, obtains his equilibrium constants from calculated values of the fugacities of the pure components in the liquid and gas phases at the existing temperature and pressure conditions as follows:

$$\frac{y f_g}{x f_L} \text{ or } y/x = \frac{f_L}{f_g} = K$$

If both the liquid and vapor are assumed to be ideal solutions the fugacities of the pure components are independent of concentrations and, consequently the equilibrium constant (K) for any one component is a function of temperature and pressure only. Values of K for the lighter normal hydrocarbons over a wide range of temperature and pressure conditions may be found in curves published by Brown and others[3,4]. As a further refinement thev also offer correction factors to be applied to the equilibrium constants for the deviation of the liquid from ideal solutions[4]. These factors are listed as a function of the liquid molal concentration.

W. K. Lewis[5] also calculates equilibrium constants from fugacity data, but with a slightly different assumption. His constants differ from Dr. Brown's in that he assumes the fugacity of the pure component in the liquid phase to be equal to the fugacity of the pure component at the existing temperature and

FIGURE # 11



Exchanger Factor Equation

$$\frac{T_{n+1} - T_1}{T_{n+1} - T_0} = \frac{E_{R-L}^{n+1} - E_{R-L}}{E^{n+1} - 1} = \phi\,(E_{R-L}, n)$$

E_{R-L} = Exchanger Factor $= \frac{H_R}{H_L} = \frac{G_R D_R C_R}{G_L D_L C_L}$

or

$$\frac{T_n - T_0}{T_{n+1} - T_0} = \phi\,(E_{L-R}, n)$$

E_{L-R} = Exchanger Factor $= \frac{H_L}{H_R} = \frac{G_L D_L C_L}{G_R D_R C_R} = 1/E_{R-L}$

n = number of ideally perfect or equilibrium heat exchangers

H = heat capacity

G = gallons through exchanger

D = density of liquid

C = specific heat of liquid

Subscript R = Rich oil

L = Lean oil

Absorption Factor Equation

$$\frac{Y_{n+1} - Y_1}{Y_{n+1} - Y_0} = \frac{A^{n+1} - A}{A^{n+1} - 1} = \phi\,(A, n)$$

under its own vapor pressure. This is in contrast to Dr. Brown's assumption that the fugacity of the pure component in the liquid phase is equal to the fugacity of the pure component at the existing temperature but at the total existing pressure. They both assume the fugacity of the pure component in the vapor phase to be equal to its fugacity under the existing temperature and pressure conditions. Since the difference between the Lewis and Brown constants lies only in the manner in which the fugacity of the pure liquid component is evaluated, Dr. Brown's "deviations from ideal solution" factors may also be applied to the Lewis constants.

At very low pressures the three constants approach each other. Their deviations at higher pressures are illustrated in figure No. 4 for n-butane at 80°F and with a concentration approaching unity. Under these conditions the Lewis and Brown constants deviate only slightly from each other. The Raoult's Law constant, on the other hand deviates seriously from the other two, especially at the higher pressures. The experimental data of Sage and Lacey[6] show that the equilibrium constants are not independent of the nature of the mixture. However, they indicate that, of the above three constants, Lewis' is the most generally applicable. They also show that all three constants may be seriously in error at pressures and temperatures in the neighborhood of the critical point of the mixture.

Magnitude of Errors Involved in the Use of the Simplified Absorption Equation

In order to show the magnitude of the errors involved in use of the simplified absorption equation we have calculated the plate to plate absorption for a relatively wet gas in a six theoretical plate absorber at 150#/sq. in. absolute. This hypothetical tower was operated with a lean oil to dry gas ratio of 31.5 gallons per M.c.f. It was assumed the 36 °A.P.I., well-stripped lean oil entered the absorber at 70°F and the gas at 70°F. The analysis of the wet gas which forms the basis of our calculations is tabulated in Table No. 1.

The method of Lewis[7] was used to estimate the absorption at the individual plates and the results of these calculations are also tabulated in Table No. 1. From this data the gas concentration gradients were calculated and plotted in Figure No. 5. This data also enabled us to calculate the heat liberated at each plate, thereby furnishing us with the means for estimating the plate temperatures. These temperatures may be found in Figure No. 6. The knowledge of the top and bottom temperatures of the tower permitted us to calculate the average equilibrium constants† for the individual components. Figure No. 3, already discussed, illustrates how well this geometric mean constant checks with the

† Constants based on the Lewis assumption were used in this calculation together with Brown's "deviation from ideal solution" factors. The Lewis constants are tabulated in Sherwood, **Absorption and Extraction** (New York, McGraw Hill Book Co,. 1937), p. 105.

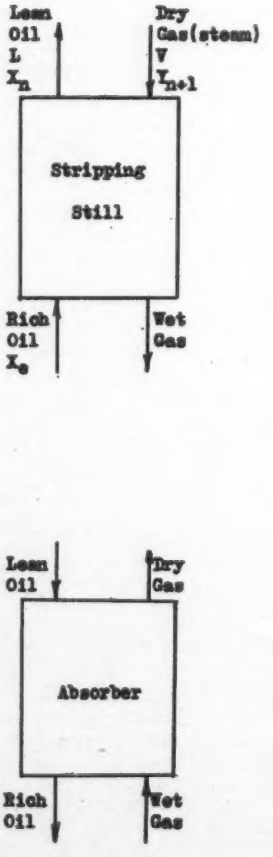
TABLE 1

	Wet Gas Analysis % By Vol.	Abs. Factor	Dry Gas Analysis % By Vol.	Mols Extracted Per 100 Mols of Wet Gas	Mols Extracted on Plate No. 1	2	3	4	5	6
Air	5.50		6.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO_2	1.70		1.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	69.33	0.0162	77.62	1.16	1.16	0.00	0.00	0.00	0.00	0.00
Ethane	9.31	0.1133	9.34	1.10	0.93	0.14	0.03	0.00	0.00	0.00
Propane	7.40	0.418	4.32	3.60	2.03	0.91	0.36	0.17	0.08	0.05
I-butane	1.37	0.832	0.32	1.09	0.20	0.19	0.18	0.18	0.18	0.16
N-butane	2.11	1.13	0.20	1.93	0.13	0.15	0.23	0.32	0.45	0.65
Pentanes+	3.28	6.50	0.00	3.28	0.00	0.00	0.00	0.04	0.28	2.96
	100.00		100.00	12.16	4.45	1.39	0.80	0.71	0.99	3.82

TABLE 2

Errors	Methane	Ethane	Propane	I-butane	N-butane
	Errors in Dry Gas Concentrations (Mol %				
E_R	+7.330	+1.105	+0.0768	−0.0354	−0.0376
E_{K_a}	+0.077	+0.064	+0.226	+0.0376	+0.0119
E_T	+7.407	+1.169	+0.303	+0.0022	−0.0267
E_{K_1}	+0.192	+0.149	+0.528	+0.0653	+0.0724
Approx. E_R	+7.21	+0.778			

FIGURE # 12



Stripping Factor Equation

$$\frac{X_o - X_n}{X_o - X_{n+1}} = \frac{S^{n+1} - S}{S^{n+1} - 1} = \phi(S, n)$$

$S = 1/A = KV/L = KM/150\ D$

X_o = concentration of component in entering rich oil

X_n = concentration of same component in lean oil

X_{n+1} = concentration of same component in liquid in equilibrium with the entering gas

zero, if steam is used

W = pounds of steam per gallon of lean oil

Absorption Factor Equation

$$\frac{Y_{n+1} - Y_1}{Y_{n+1} - Y_o} = \phi(A, n)$$

nth root mean constant. The absorption factors calculated from the mean constants are tabulated in Table No. 1.

We now have sufficient data to estimate the magnitude of the error terms derived above.

From the absorption on each plate, the gas concentrations at the several points in the tower, and the absorption factor we are able to calculate the "ratio error" or the error due to the use of the lean oil to dry gas ratio in the simplified absorption factor equation. These errors (E_R) have been calculated for methane, ethane, propane, iso-butane, and n-butane and are listed in Table No. 2. The errors as calculated from the equation are in the form of corrections to be algebraically added to the dry gas concentrations. Note that their magnitude is within the accuracy of our present day fractional analysis methods, excepting in the case of the methane and ethane errors.

The large methane and ethane errors are significant in that they explain the apparent inconsistency of the absorption equation. A glance at Dr. Brown's curves for the solution of his absorption equation will show that the solution can never exceed one; consequently the dry gas concentrations, as calculated by the absorption equation, will all be less than the respective concentrations in the wet gas. Therefore when the equation is applied to all the constituents of a gaseous mixture the resulting dry gas concentrations in mol percentages will not add up to 100%. For example, the application of the equation to the wet gas in Table No. 1 will produce dry gas concentrations that add up to only 89.5%. If the errors in Table No. 2 are now algebraically added to the calculated concentrations, the corrected concentrations will add up to about 98%. We must conclude then that the absorption equation when applied to the so called carrier constituents will produce results far too low for any practical use.

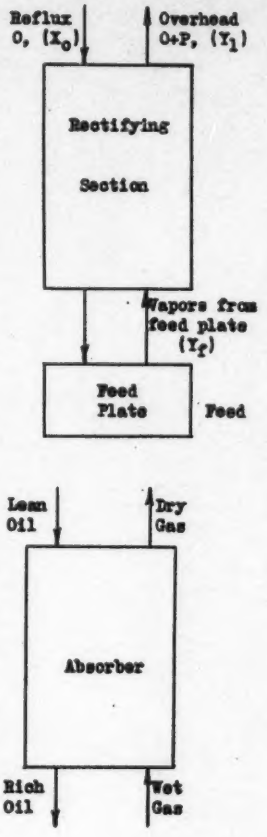
One way of correcting the methane and ethane concentrations would be to derive an easily evaluated equation for these corrections. The following equation is offered as a means of obtaining the minimum correction to be added to the methane and ethane concentrations.

$$E_R > Y_{n+1}\left(\frac{L}{V} - A\right) \frac{(A-1)}{(A^{n+1}-1)} \cdot \frac{\Sigma a}{L}$$

A better method is to assume that the methane and ethane extractions will be equal to that contained in the rich oil in equilibrium with the wet gas. This is logical since the oil, after becoming saturated with methane and ethane on the first few trays, releases some of these constituents as the oil becomes progressively warmer and the gas progressively leaner in these constituents as it flows down the tower. With this assumption the dry gas concentrations of methane and ethane may be expressed as follows:

FIGURE # 15

The Application of Kremser Factors to the Stabilising Unit - Rectifying Section



Split O'head Stream or Total Condensation

$$\frac{Y_f - Y_1}{Y_f - K_1 Y_1} = \phi\,(R, n)$$

Partial Condensation

$$\frac{Y_f - Y_p/K_a}{Y_f - (K_1/K_a)Y_p} = \phi\,(R, n)$$

R = Rectifying Factor

$$R = \frac{1}{K_R}\left(\frac{O}{O+P}\right)$$

$\frac{O}{O+P}$ = Ratio reflux to reflux plus top product; mols per mol or gallons per gallon

Y_f = concentration of component in vapor from feed plate

Y_p = concentration of same component in vapor from accumulator

Y_1 = concentration of same component in vapor Overhead

K_1 = equilibrium constant for component @ top plate conditions

K_R = average equilibrium constant for component @ rectifying section conditions

K_a = equilibrium constant for component @ accumulator conditions

Absorption Factor Equation

$$\frac{Y_{n+1} - Y_1}{Y_{n+1} - Y_0} = \phi\,(A, n)$$

TABLE 3

	n	$\frac{L+\Sigma^n_1 a}{V+\Sigma^n_1 a}$	$\frac{L}{V} - \frac{L+\Sigma^n_1 a}{V+\Sigma^n_1 a}$
Lean Oil			
Dry Gas	0	0.485	
Between Plates 1 - 2	1	0.506	−0.021
2 - 3	2	0.513	−0.028
3 - 4	3	0.517	−0.032
4 - 5	4	0.520	−0.035
5 - 6	5	0.525	−0.040
Below 6	6	0.541	−0.056

$$Y_1 = Y_{n+1}(1 - A')\frac{(V+\Sigma a)}{V} \qquad \text{where } A' = \frac{L+\Sigma a}{V+\Sigma a}\,\frac{1}{Kn}$$

It is interesting to compare this with the expression for Y_1 from the absorption equation when A is small.

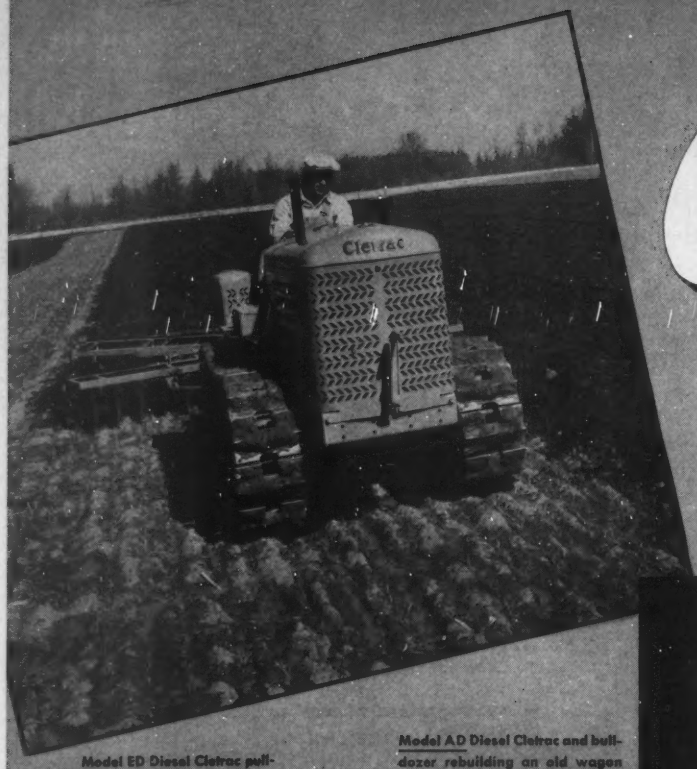
$$Y_1 = Y_{n+1}(1 - A)$$

For a first approximation A may be used in place of A^1 in the first equation.

The application of this procedure to the wet gas of Table No. 1 resulted in dry gas concentrations that added up to substantially 100%. The resulting dry gas is also tabulated in Table No. 1.

(To Be Continued)

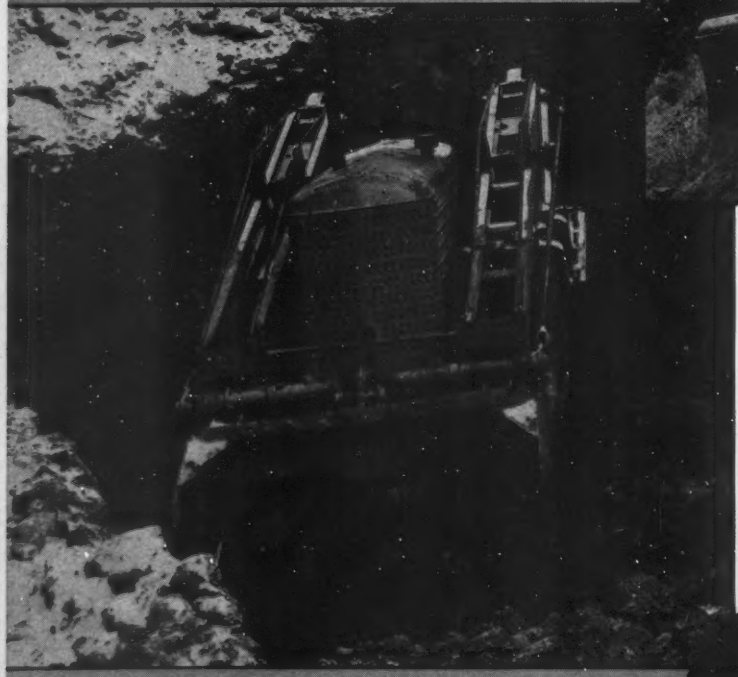
Cletrac uses



Model ED Diesel Cletrac pulling a 10' disc in wet, sandy soil near Salem, Oregon.

Model AD Diesel Cletrac and bulldozer rebuilding an old wagon road for use of trucks in bringing out logs at Addy, Washington.

Model BD Diesel Cletrac and front end loader excavating a basement near Cleveland, Ohio.



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NEW RPM DELO

(Diesel Engine Lubricating Oil)

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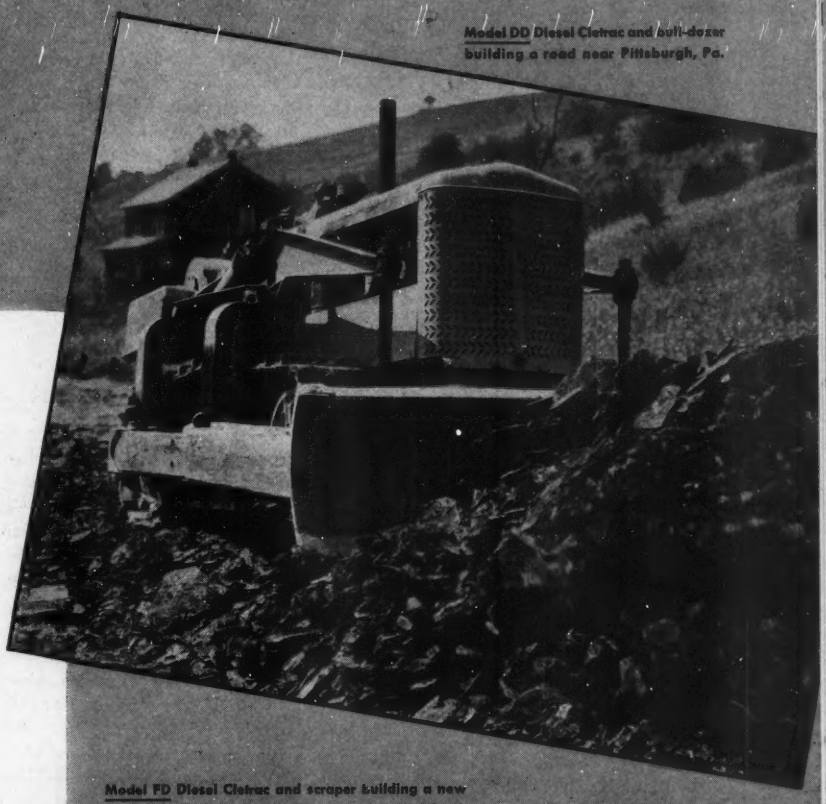


Model DD Diesel Cletrac and bull-dozer building a road near Pittsburgh, Pa.

OFFICIAL ADVICES from the Cleveland Tractor Company:

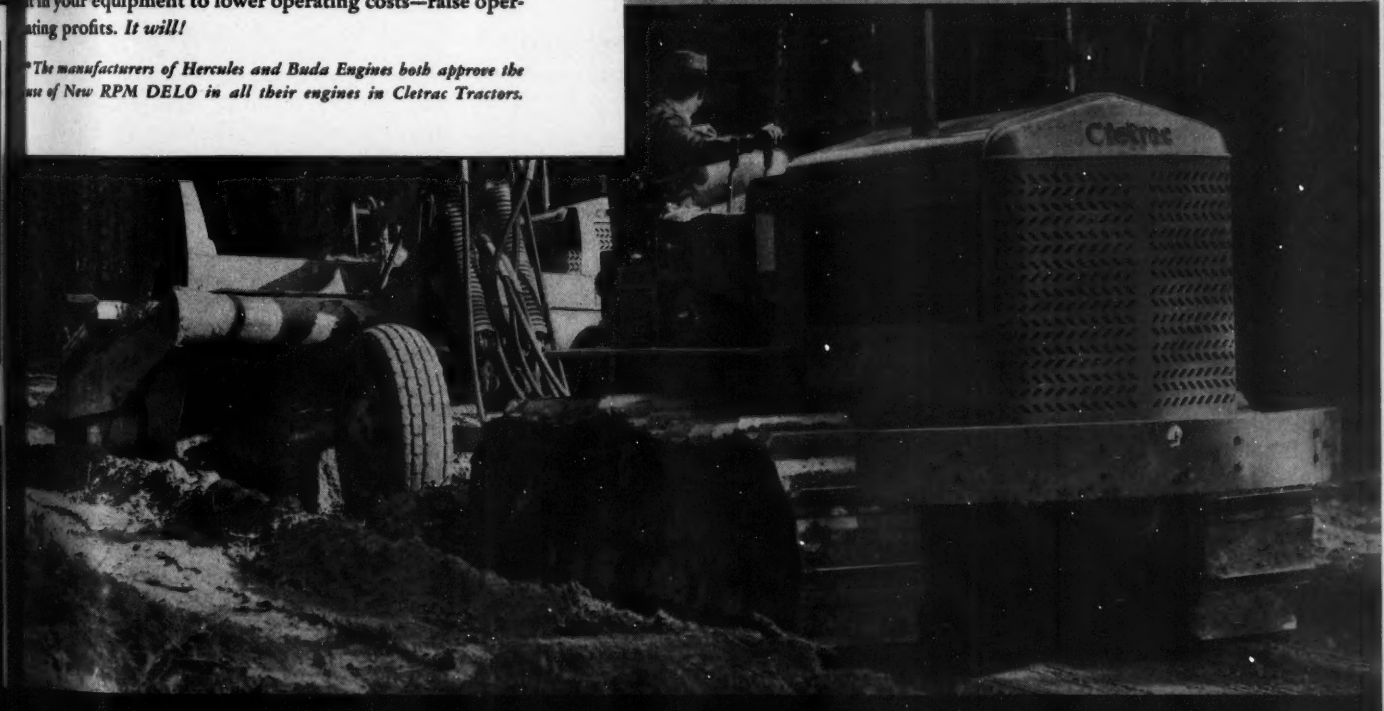
"We endorse New RPM DELO as a superior lubricant for the *Hercules and *Buda Diesel Engines which power Cletrac Tractors. We have made arrangements to use this product exclusively at our factory in all our Diesels. In future, therefore, all Cletrac Diesel Tractors will be shipped from the factory with New RPM DELO in their crankcases."

During the critical *break-in,* New RPM DELO brings Cletrac's rings, pistons, liners through to a mirror-smooth finish that lengthens full-power engine life! More—it must prevent ring sticking—*and it does.* Keep engines free from objectionable carbon—*and it does.* Guard Cletrac's alloy bearings from corrosion—*and it does.*

New RPM DELO is lubricating more and more Diesels of every size and type—stationary, automotive, marine. Put it in your equipment to lower operating costs—raise operating profits. *It will!*

** The manufacturers of Hercules and Buda Engines both approve the use of New RPM DELO in all their engines in Cletrac Tractors.*

Model FD Diesel Cletrac and scraper building a new road for the Bureau of Public Roads in Maryland.



STANDARD OIL COMPANY OF CALIFORNIA

W. K. Breeze Named J. & L. Pacific Coast Head

Changes involving its District Sales Offices in New York, Philadelphia, and the Pacific Coast are announced effective Feb. 1, 1940, by Jones & Laughlin Steel Corp., Pittsburgh.

W. K. Breeze

William K. Breeze has been appointed Pacific Coast manager with supervision over the district offices at Los Angeles, San Francisco, and Seattle. He will make his headquarters in Los Angeles. Since March, 1938, he has been District sales manager in New York, and has been in the steel business since February, 1929, when he started with J & L in its Cincinnati District office.

John B. DeWolf has been appointed District sales manager in New York. Since March, 1938, he has been District sales manager in Philadelphia for J & L. Mr. DeWolf has been in the steel business since 1918, having started with Liberty Steel Co., which was subsequently merged into Republic Iron & Steel Corp.

Herbert B. Spackman has been appointed District sales manager in Philadelphia. Since March, 1938, he has been Assistant District sales manager in Philadelphia, and has been in the steel business since 1923, when he started with the Bethlehem Steel Co. and served in various sales capacities in Bethlehem, Buffalo, and Philadelphia, before coming to J & L.

Lane-Wells Transfers Bowsky to Houston Office

Announcement is made by Norman L. Dorn, vice-president of the Lane-Wells Co., of the transfer of Merle C. Bowsky from the Los Angeles to Houston office. Mr. Bowsky is numbered among the prominent engineers in the Lane-Wells organization. Most of his work during the past year has been in connection with the development of the Electrolog method of electrical open hole logging.

It is understood that Mr. Bowsky will supervise the engineering work on Electrologging in the Gulf Coast.

Mr. Dorn also announced the starting of new field construction work at New Iberia, Louisiana. Offices, warehouses, etc., are being erected at a reported cost in the neighborhood of $10,000.

Henry L. Gardner Joins Ideco on Coast

An announcement has just been made by L. R. Wells, president, International Derrick & Equipment Co. of California, of the appointment to the California sales organization of Henry L. Gardner.

Mr. Gardner has long been identified with the California oil industry, his early operations having been as an executive of the E. J. Miley Corp., after which he went on the other side of the desk and joined with the sales organization of Hydril Co., and more recently Petroleum Equipment Co.

The numerous friends of Mr. Gardner's will be happy to learn of his new association, and to wish him every success.

New C. N. G. A. Liquefied Gas Bulletin Is Completed

After nearly three years of intensive committee work, the Liquefied Petroleum Gas Committee of the California Natural Gasoline Association, under chairmanship of John S. Gallagher of The Texas Co., has completed its work on and published the association's new bulletin, TS-392, "Tentative Specifications and Tentative Standard Methods of Test for Liquefied Petroleum Gases."

The new bulletin is now ready for distribution and copies may be obtained by addressing George L. Tyler, Secretary, California Natural Gasoline Association, 510 West Sixth Street, Los Angeles, Calif. The price of the bulletin is $1.00 to association members and $1.50 to nonmembers.

The bulletin's purpose is to present tentative standard specifications for the purchase and sale of liquefied petroleum gas mixtures varying from commercial butanes through mixtures of butanes and propane to commercial propane. It sets up six standard grades of liquefied petroleum gases in this range and presents tentative standard methods of test, setting forth procedures by which compliance with the specifications may be established.

There is an evident need for the standards set up in this bulletin and their acceptance by the industry will help simplify the relations between manufacturer, distributor, equipment designer and consumer and, on the whole, it will contribute to the greater economy and increased safety in the use of liquefied petroleum gases.

The content of the bulletin includes specifications for the six C.N.G.A. standard grades; description and definition of a liquefied petroleum gas; general requirements; methods of test; standard methods for determination of end point characteristics, vapor pressure, specific gravity by pycnometer and specific gravity by hydrometer. The bulletin is complete with an appendix giving tables of multipliers to convert volume at any temperature to volume at 60°F.; physical characteristics of lighter hydrocarbons; relations between the six C.N.G.A. standards and requirements of various regulatory bodies as to minimum design pressure of containers; and a vapor pressure conversion chart for liquefied petroleum gas.

The California Natural Gasoline Association Liquefied Petroleum Gas Committee is a sub-committee of the association's Technical Committee of which W. W. Robinson, Jr., of The Texas Co., is chairman. Those serving on the L.P.G. Committee are John S. Gallagher, The Texas Co., chairman; F. S. Burt, General Petroleum Corp.; A. J. Bush, Tide Water Associated Oil Co.; A. L. Hendrickson, O. C. Field Gasoline Corp.; Fred Hough, Southern Counties Gas Co.; C. L. Hutchings, Tide Water Associated Oil Co.; G. N. Hile, Standard Oil Co. of Calif.; A. N. Kerr, Imperial Gas Co.; C. E. McCartney, Petrolane, Ltd.; F. O. Olmstead, Union Oil Co. of Calif.; C. L. Parkhill, Parkhill-Wade; Turner Smith, General Petroleum Corp.; E. J. Squire, Shell Oil Co., Inc. This bulletin was published under supervision of the association's Editorial and Revisions Committee chairmaned by G. N. Hile, Standard Oil Co. of Calif., with R. R. Crippen The Texas Co.; R. H. Pierson, Gilmore-Dabney, Inc.; R. O. Maass, General Petroleum Corp.; and H. J. Multer, Union Oil Co. of Calif., as committee members.

Donkey pumps—small pumps, once mulish in performance, used for odd jobs of pumping.

Not even the warmth of a spring day could keep C.N.G.A.'s Liquefied Petroleum Gas Committee from their job of preparing the technical bulletin which has just been released. From left to right they are: E. J. Squire, Turner Smith, A. N. Kerr, C. L. Parkhill, John S. Gallagher (chairman), C. L. Hutchings, A. J. Bush, and G. N. Hile. Committee members not shown in the picture are F. S. Burt, A. L. Hendrickson, Fred Hough, C. E. McCartney, and F. O. Olmstead.

B. I. Graves Is Made Eastern Associated Head

With the promotion of B. I. Graves to an executive post as chairman of the Operating Committee of the Eastern Division of Tide Water Associated Oil Co. in New York, important changes in personnel in the Associated Division with headquarters in San Francisco are announced.

P. E. Allan has been advanced to the position of general sales manager of the Associated Division. In his new post Mr. Allan will have complete charge of all sales for the entire Pacific Coast marketing territory served by Associated. He first entered the services of the company in June, 1915, and his rise through successive positions of responsibility, including the past eleven years as domestic sales manager, is climaxed by his elevation to the highest post in the sales department of the Associated Division.

W. A. Reanier, who for the past nine years has served as manager of White Oil Sales, advances to the position of domestic sales manager. Mr. Reanier has been in the service of the company for twenty-four years in various positions in the Sales Division.

Other promotions announced include: J. M. Evans becomes assistant domestic sales manager; H. A. Jackson, who has been district sales manager, with headquarters in Seattle, comes to San Francisco succeeding Mr. Reanier as manager of White Oil Sales; E. C. Heinz replaces Mr. Jackson as Washington District sales manager at Seattle.

K. E. Kneiss is appointed manager of Asphalt and Road Oil Sales; J. J. Lermen, Jr. is appointed export manager and J. H. Farry is appointed assistant export manager.

B. I. Graves

P. E. Allan

Union Oil Promotes Pyle Asst. Chief Engineer

Howard C. Pyle, formerly production engineer for Union Oil Company, has been appointed assistant chief petroleum engineer, according to a recent announcement made by W. S. Eggleston, chief petroleum engineer for the company.

Recently re-elected chairman of the American Petroleum Institute's Pacific Coast division of production, Pyle began his association with Union Oil upon graduation from the University of California in 1927.

Purchasing Personnel-ities

By Leo S. Busby,
Associate Editor,
Southwestern Purchasing Agent

CHARLEY KEEBLE

The mere mention of the name Union Pacific immediately conjures up in the average mind romantic visions of the early West; glistening steel rails laid with frantic haste over scorching plains and through treacherous mountain passes; ancient, wood-burning locomotives belching thick black smoke from their queer looking funnels; sweating, cursing, laughing men of iron clearing a path for their iron horses; and, finally, that famous golden spike that linked with bands of steel the East and the West. The romance of the West, inseparable with the history of Union Pacific!

Charley Keeble

Perhaps there were some such thoughts as these running through the mind of young Charley Keeble when, in 1919, he chose railroading instead of the oil industry as his life's work. Perhaps he did not even give the oil business a second thought, dismissing it, with a shrug of his shoulders, as a rather dull, dirty, prosaic way to make a living.

But now, after all these years, the oil industry has actually caught up with Charley, and we find him these days at the purchasing agent's desk in the Union Pacific offices overlooking Pershing Square, knee-deep in requisitions calling for such unromantic items as oil derricks, line pipe, casing, cement, sucker rods, pumps, and the like. With 165 producing wells at Wilmington, and 7 strings now drilling, Union Pacific is more than a little in the oil business, and these days Charley sometimes wonders if Union Pacific is really the name of a railroad, or just a designation to be tacked up on one more oil derrick.

Charley Keeble is a true native son of California, having been born and raised right here in Los Angeles. In his earlier days, he must have lived near the railroad yards where he developed an early love for engine smoke, for after leaving high school he immediately went to work in the stores department of the Southern Pacific. After a year of rustling locomotive parts, he decided that after all maybe education was the thing, and so matriculated at Occidental College.

After two years at college the World War took over and Charley found himself in the Officers' Training School. After the war ended, he quit school and went back to his first love-railroading. On January 2, 1919, he went to work in the stores department of the Union Pacific at Los Angeles.

For about three and a half years he handled warehouse stocks, and then was transferred to the office of the Chief Engineer, where he worked on time rolls and insurance detail. A year of this and Charley went back to materials and supplies, this time in the purchasing department. Six years later, he became chief clerk of the department, a position which carried with it the duties of assistant purchasing agent. Two years ago, on September first, he was made purchasing agent. Incidentally, Charley, at the age of 40, is one of the youngest officers on the Union Pacific System.

Charley Keeble's duties involve the purchase of all materials for the Union Pacific System required between Los Angeles and Salt Lake City. An idea of the extent of these purchases may be gained from the fact that over 100,000 different items are regularly carried in warehouse stocks throughout the system.

The Los Angeles office is also responsible for the purchase of supplies and materials for several affiliated organizations, among them, the Union Pacific Stage Company, the Overland Terminal Warehouse Company, and the Las Vegas Land and Water Company.

But to get back to the petroleum phase of Charley Keeble's job, we asked Charley how he felt when suddenly the task of buying millions of dollars worth of oil well equipment was unceremoniously dumped in his lap. Charley just grinned that crooked, little grin of his, and said that the way it had worked out, it really hadn't been too tough. In the first place, the company had prevailed upon Bill Reinhardt, general manager of Kettleman North Dome Association, to accept a position with Union Pacific as Vice President in charge of oil development. In the second place, the Hall-Baker Company, a petroleum development company, was engaged to handle the actual field activities. Since all drilling was done by outside drilling contractors, Charley had only to buy such items as remained on the property permanently after the wells were brought in. He had none of the worries of the buyer of oil well drilling equipment. With the help of Bill Reinhardt, and the Hall-Baker Company, Charley received a more or less gentle initiation into the intricacies of oil industry purchasing.

Charley tells us that in the three years that Union Pacific has been interested in the oil business, they have expended over ten millions of dollars in development work at Wilmington. They now have 165 completed wells on the property with a well potential of between 250 and 300. By the time that potential is reached, Charley Keeble will undoubtedly be very much an oil man.

Between keeping the Union Pacific streamliners running and the Union Pacific oil wells drilling and pumping, Charley has pretty much of a handful. However, whenever the occasion permits and the competition doesn't look too tough, Charley likes to chase that little white ball around the fairway. He admits, too, a very strong liking for the company of his family, and enjoys a certain delight in the little menial tasks around his own backyard.

Wonder if he ever goes for a train ride?

Earle D. Moiles Passes Away Feb. 5

The host of friends of Earle D. Moiles will regret to learn of his death on Feb. 5th, from the effects of pneumonia complicated by a heart condition. Mr. Moiles was associated with the Merco Nordstrom Valve Co., a subsidiary of the Pittsburgh Equitable Meter Co., and at the time of his death, was manager of the Pittsburgh operations of the Valve Co.

Mr. Moiles was a graduate mining engineer of Stanford University and practiced his profession for many years in the western states, Canada and Mexico. He was employed by the Merrill Co., an engineering firm of San Francisco, at the time they decided to manufacture the Nordstrom Valve. He was then assigned to the Merco Nordstrom Valve Co. in an engineering capacity and, as their operations expanded, was placed in charge of their eastern factory, first at Belleville, N. J., and then in Philadelphia, Pa., later being transferred to Pittsburgh.

Mr. Moiles is survived by his widow, a son, Earle, Jr., and a daughter, June. His kindly and understanding manner endeared him to all with whom he had contact, and his passing will leave a void difficult to fill.

You are reading the Pacific Coast oil men's home paper.

Thomas Verner Moore New A.I.M.E. Chairman

Thomas Verner Moore, head of Production Research Department of the Humble Oil and Refining Co., of Houston, Texas, has been elected chairman of the Petroleum Division of the American Institute of Mining and Metallurgical Engineers for 1940 according to an announcement made by W. H. Geis, Union Oil Co. of California, the present chairman.

A prolific author of technical papers on petroleum, Mr. Moore's outstanding work in this field has been concerned with the development of mathematical formulae to determine the relationship between the rate of production of oil and gas from a reservoir and the rate of decline of the average reservoir pressure. One of these formulae had to do with the forecasting of reservoir pressures in the East Texas field for any given rate of production. His predictions were contrary to the generally accepted views in the early life of the field, but actual performance has shown that he was correct in his calculations. He has been very active in the affairs of the Petroleum Division of the Institute and was a leader in the formation of the present Gulf Coast Section of the A.I.M.E., Petroleum Division.

C. J. Coberly, president of Kobe, Inc., Huntington Park, Calif., was elected associate chairman of the Division. C. V. Milliken, of the Amerada Petroleum Corp. of Tulsa, Okla., and H. H. Power of the Department of Petroleum Engineering, University of Texas, Austin, Texas, were elected members of the Executive Committee; C. H. Keplinger of Wichita, Kans., and E. L. Rawlins, Petroleum Engineer, United Gas Public Service Co. of Houston, Texas, were elected associate vice chairmen of Production Engineering.

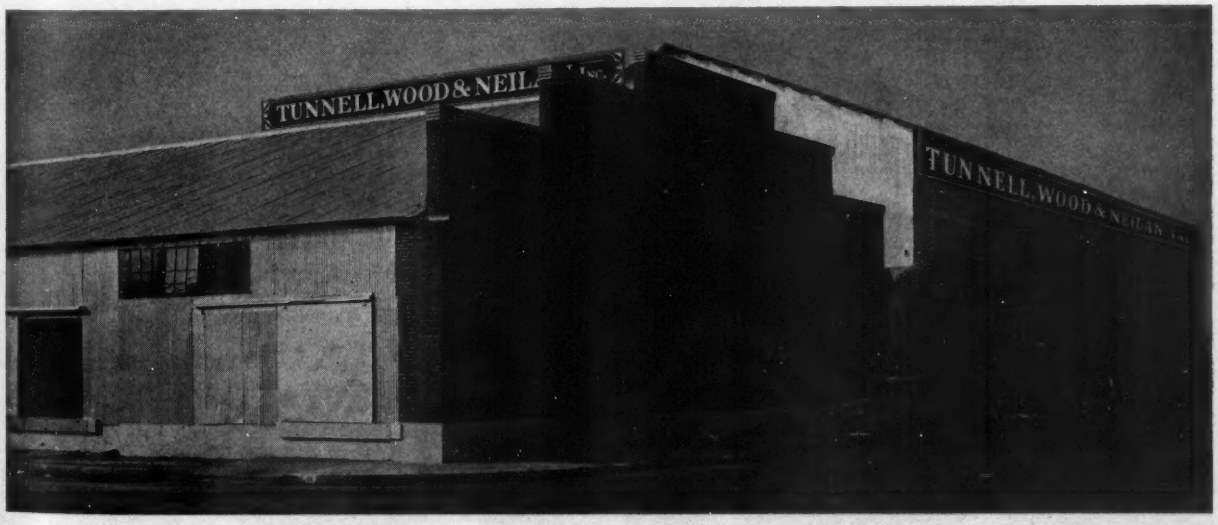
Officers re-elected for the year were: B. C. Craft, associate professor of Petroleum Engineering, Louisiana State University, Baton Rouge, La., secretary and treasurer; W. H. Geis, Union Oil Co. of California, Los Angeles; E. A. Stephenson, professor of Petroleum Engineering, University of Kansas, Lawrence, Kansas; and W. B. Heroy, Pilgrim Exploration Co., Houston, Texas, members of the Executive Committee; F. B. Plummer, geologist, Bureau of Economic Geology, University of Texas, Austin, Texas, vice chairman Production Engineering; Roy E. Collom, vice president, Continental Oil Co., Los Angeles, and F. G. Tickell, professor of Petroleum Engineering, Stanford University, California, associate vice chairmen of Production Engineering; J. Terry Duce, geologist, The Texas Co., New York City, vice chairman for Production; Basil B. Zavoico, Chase National Bank, New York, associate vice chairman for Production; D. L. Katz, assistant professor of Chemical Engineering, University of Michigan, Ann Arbor, Mich., vice chairman for Engineering Research; Lyon F. Terry, Department of Petroleum Economics, Chase National Bank, New York City, vice chairman for Economics; and Walter Miller, vice president, Continental Oil Co., Ponca City, Okla., vice chairman for Refining Engineering.

Nomads Hold Inauguration Ball

The first Inaugural Ball of the Los Angeles Chapter of the Nomads, held on Friday evening, Feb. 16 at the Pacific Coast Club in Long Beach, proved to be an outstanding social event of the oil industry. Two hundred people assembled to do honor to the newly elected and the retiring officers of the organization. Refreshments were served from seven to eight when the Nomads and their guests, among whom were oil men from several foreign countries, gathered in the main dining room for a dinner dance.

The master of ceremonies was Frosty Martin, chairman of the committee in charge of the affair, who introduced the officers. Short talks were given by Ted Sutter, the new president and Elmer Decker, retiring president. Little time was spent in speeches, however, since every effort was made to make the evening a strictly social event. The efforts were eminently successful. Credit for this success goes to the entire committee consisting of Frosty Martin, Bill Bettis, Larry Coker, Fred Ripley and Jack Walton. The Nomad song was sung by George Anderson who followed this with several Scottish songs before the knives and forks began to rattle. Dancing was interrupted at one point by Frosty Martin who presented Elmer Decker with a gavel, this ceremony taking place on the dance floor.

The new officers inaugurated were Ted Sutter, president; Sam Bowen, vice-president; Bill Bettis, secretary-treasurer; Earl Rees, asst. sect.-treas.; Ernie Fowks, Sergeant-at-arms; and Pinky Robinson, asst. sgt.-at-arms. The retiring officers were Elmer Decker, president; Fred Ripley, vice-president; Bill Bettis, secretary-treasurer; Earl Rees, asst. sect.-treas.; Henry Pullman, sergeant-at-arms; and Ernie Fowks, asst. sgt.-at-arms. The new national regents inaugurated were Elmer Decker and Bill Bettis.



Tunnell, Wood & Neilan, Inc., who have completely stocked oil well and refinery supply stores in Los Angeles and Bakersfield, have moved into the extensive plant shown above, a change necessitated by expansion of business in the nationally known oil tools, tubular goods, lines, valves, and specialties they handle. The address of the new Los Angeles headquarters is 2068 East 37th Street.

LAUGH THIS OFF

Frank Morgan, discussing the doodle bug, is distinctly of the opinion that the twillow is much more effective than the twash—the twillow being a twig of a willow, and the twash—a twig of an ash.

Personally, we believe that in the long run it is much better to use the noodle than the doodle.

Whereupon **Max App** takes the floor to remark that while a married man always has a better half, a bachelor occasionally has better quarters.

A bachelor, of course, being a guy who never makes the same mistake once.

Years ago, according to **Hal Halvorsen**, it was the custom among gaugers to throw rocks at the tanks to find out if they were filled, and ready to ship. The practice was stopped, however, because it woke up the pumpers.

And **Tom Taggart** tells us about a lad who has been going with a telephone operator up in the Valley for eight years —and is still waiting for an answer.

Ike Burroughs, by the way, has had to throw out his bedroom slippers at last —the patent has expired.

Proving once again that the guy who is always seeing red rarely looks beyond the end of his nose.

Which recalls the job seeker who tackled **Harry Ivory** a while ago. Says Harry, "What is your occupation?" "Inventor," was the immediate response. "Is that so! What have you invented?" was the next query, and Harry lost a caster out of his chair when the hopeful one chirped, "Oh, nothing yet. I'm still looking."

On the subject of invention, **Marion Dice** describes a research engineer as a guy who thinks up more things we don't need.

And **Bill Saul** up at San Francisco is working on a rubber door knocker to keep away peddlers.

On the other hand, it's time some smarty invented an instrument that would tell where a man goes when he "just steps down to the corner to mail a letter."

Now comes one of the greatest shocks we have ever sustained in a long and promising career. We were introduced the other day to a lad with whom we have had many telephone conversations but had never met. He was a bit jittery over meeting such a celebrity, and blurted out, "Well, sir, now that I know you, if somebody described you to me, I wouldn't believe it."

It was quite a let down after just receiving mention in a big news story a short time before. The story? Sure! It said, "In 1939 there were 29,485,690 motor vehicle owners in the United States."

"I've had this car for five years and have never paid a dime for repairs," said the motoring enthusiast to **Red Wilson**. "Yeah," says Red, "so the garage man tells me."

By the way, it has been estimated that if all the cars in Los Angeles were placed end to end with no room whatever between them, it would be 5:30 p. m. on Wilshire Boulevard.

The insinuation has been made that a Long Beach rousty hocked his saxophone for an engagement ring. Nothing of the sort—the guy just wants to keep both hands free for defense.

In which connection we might once more point out that you should always have a girl's number before you give her a ring.

We never had much luck with the girls—when we were at that age we were turned down at the corners oftener than the pages of Gone With The Wind.

Saying which we beat a hasty retreat. Remember, a street car conductor is one of the few guys who can tell a woman where she gets off.

And there's no speed limit on the road to success.

BAKER

The Big Idea in Successfully Cementing Casing is to use equipment which provides in perfect balance the three important features of . . . STRENGTH, VALVE EFFICIENCY and DRILLABILITY.

Field Development

San Joaquin Valley

Ten Section Outpost Yet Above Stevens

Shell Oil Co.'s James Slough-KCL No. 1 in sec. 6,31-26 is drilling near 9950 ft. in cherty shale topped at 9770 ft. Located two miles south of Ten Section field, where the productive Stevens is found near 8000 ft. and a mile and a quarter northeast of Cole's Levee where Stevens is found at 9500 ft., the try is already below the productive top of two adjacent fields, and appears to offer little chance at comparable production.

It remains possible, however, that the zone will be found productive even at this low point, or that more productive horizons will be encountered below present levels.

San Emigdio Driller Gets Faint Showings

Drilling with bottom near 13,650 ft. in oil stained hard sand and streaks of shale, Shell Oil Co.'s KCL No. 2A-52-13 is experiencing a repetition of the slight showings encountered at intervals below 12,370 ft. where hard sand showing faint cuts was found.

Located on the San Emigdio plains between the Maricopa-Ridge Route highway and the hills, sec. 13,11-22, the well is the latest of a long series of tests in the south Valley area.

Comanche Point Try Prepares To Spud In

With only a few mechanical details between expectation and accomplishment, the long anticipated test of the Comanche point area is near. The well, Tejon Minerals No. 1, to be drilled near the west quarter corner of sec. 27,32-29 by Oil Scout, Inc., is rigged up to try undrilled acreage lying southwest of previous unsuccessful wells on the flat lands east of the highway and south of the Arvin area.

Find Salt Water Marker In Tulare Lake Wildcat

The first deep test drilled at the westerly limits of Tulare lake, Shell Oil Co.'s Cohn Estate No. 6-4, topped the salt water marker near the 10,000 ft. mark. Customarily found between 5000 and 6000 ft. in the Kettleman North Dome field, some six miles to the southwest, this

SAN JOAQUIN VALLEY WILDCATS

Area	Well	No.	Section	Depth	Status
	Fresno County				
Cantua Creek	The Texas Co., S.P.	1	23, 17-15	7965	Drilling
Coalinga	Lewis, C. H.	1	18, 21-15	800	Idle
	Miggs Oil Co.	8	11, 20-14	232	Abandoned
	Tidewater Assoc. O. Co., Guardian	22	2, 20-15		Foundation
Gatos Creek	Gatos Creek Oil Co.	1	19, 19-13	466	Idle
Huron	The Texas Co., Boston	1	14, 20-18	7005	Drilling
Mendota	Jergins Oil Co., Cheney Ranch	1	29, 14-13	6527	Drilling
	Kern County				
Antelope	Par Petroleum Co.	1	32, 25-17	3032	Idle
Belridge—South	Union Oil Co., Fitzgerald-Weston	1	13, 29-21		Rigging up
Buena Vista	Gen. Pet. Corp., B.V.A.	1	1, 32-24	11265	Drilling
	Shell Oil Co., B.V.A.	45–9	9, 32-25	10292	Drilling
Buttonwillow	Union Oil Co., Bowerbank	4–23	23, 29-24	12144	Plugged 10,850 —Testing
Devil's Den	The Texas Co., Beer	2	8, 26-19	1202	Abandoned
	Trigg, H. C.	1	11, 25-18	400	Drilling
Edison	El Tejon Oil & Ref. Corp., Douglas	2	32, 29-29	4280	Drilling
	Goodrum & Vincent. Inc., S.P.	3	31, 29-30	418	Cleaning out
	Mayes, A. S.	1	5, 30-29	4222	Testing
	O'Reilly, Francis, Edison-Land	2	5, 30-29	4103	Idle
	O'Reilly, Francis, Edison-Seale	5–28	5, 30-29		Location-Equip.
Kern Front	Davis Petroleum Co.	1	13, 28-27	1804	Testing
Kern River	Sleeper Ridge Oil Co.	1	15, 29-28	1797	Idle
McKittrick	Burt & Taylor, Taylor	1	30, 30-22	1047	Idle
	Calstan Pet. Co., Webber	1	34, 30-22	1220	Abandoned
	Franco-Western Oil Co.	17	8, 30-22		Location
	Deal, O. T., M.&M.	1	30, 30-22	6664	Cleaning out
Panorama Hills	Burrhus, V. E.	2	31, 31-22		Rig
San Emigdio	Shell Oil Co. KCL 2A	52–13	13, 11-22	13629	Drilling
Shafter	Continental Oil Co., Comm.	1	12, 28-24	9421	Drilling
Shale Hills	Gamble & Oliver, Abbott	1	7, 27-19	2047	Idle
	The Texas Co., McD-Theta	1	12, 28-19	2470	Drilling
Ten Section	Richfield Oil Corp., James-Slough KCL	1	6, 31-26	9946	Drilling
	Kings County				
Kettleman— South Dome	Bristol Oil Co., Smith	1	35, 24-19	8054	Idle
Reef Ridge	Chuka Oil Co.	2A	10, 23-16	185	Idle
So. Tulare Lake	Dudley, Ben	1	11, 24-20	2600	Deepening
W. Tulare Lake	Shell Oil Co., Cohn Estate	6–4	4, 22-19	10035	Drilling
	Tulare County				
Richgrove	Collins, James F., Konda	1	25, 24-27	1400	Drilling

places the current try approximately 4000 ft. lower on structure. A wide divergence such as this is not necessarily damaging since equally wide spreads are known to exist in comparable areas in the South Valley, and have not prohibited commercial production.

Located in sec. 4,22-19, the test is the first to prospect what has been considered by many one of the brighter shots at new production.

Six miles south of the lake bed, Ben Dudley is deepening the old Athalie Irvine No. 1 in sec. 11,24-20. Drilled late in 1938 to 2500 ft., the well is reported to be deepening to approximately 3500 ft., at which point gas may be found which will correlate with the gas zones in the Dudley Ridge area.

14D JENSEN Jack for handling polish rod loads up to 14,000 lbs. Wire line head. Mounted on sub-base.

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If you have lived in a house where the windows had to be propped up with sticks, you'll remember how hard they were to raise and lower.

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In JENSEN Units we employ an efficient combination of rotary counterbalance and adjustable static counterbalance to avoid stress and strain and waste of power. Everything about a JENSEN well operates smoothly, as though in well-oiled grooves. You thoroughly enjoy their efficiency and dependability.

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Buttonwillow "Cat" Tests Discouraging

A series of tests up hole from bottom at 12,144 ft. has done nothing to encourage hopes for the ultimate success of Union Oil Co.'s Bowerbank No. 4-23 in sec. 23,29-24 of the Buttonwillow district.

Latest test was made from 10,860 ft. where swabbing produced fluid consisting of 35% oil and 65% salt water, paralleling the experiences of California Exploration Co.'s deep test in the northwest corner of the township.

Two Operators Active In Elkhorn-Carriza Area

V. E. Burrhus Haberkern No. 1, in sec. 21,32-22, is drilling in black shale at 2160 ft. after finding the marker at 1990 ft. Preparing to start the second try in the area, is Newton Development Co. which plans to drill well No. 1 in sec. 3,32-21.

Superior Hits New Rio Bravo "High"

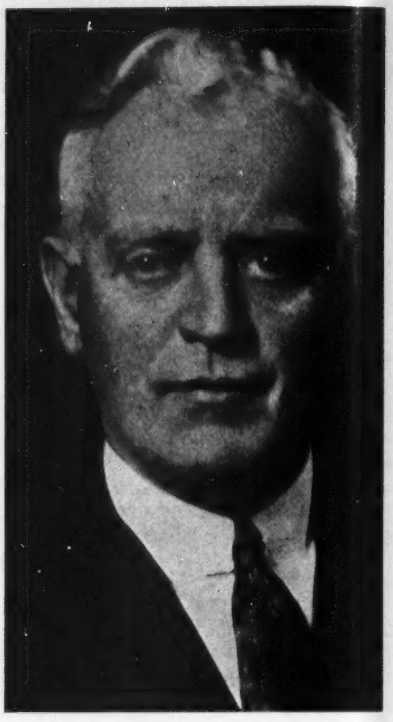
The most northwesterly of the Rio Bravo field wells, Superior Oil Co.'s Roe No. 1, has proved to be the highest structurally of any well in the field. Located near the center of the southwest quarter of sec. 27,28-25, the prolific sands were found at a sub-sea level of 10,820 ft. Situated on the main northwest-southeast axis, the latest well is added proof that the field limits are far from being determined, since each successive well up the axis has been progressively higher.

Contours of the field, drawn on top of the Rio Bravo sands, indicate that possibly only a small portion of the ultimately productive area has been developed.

Superior, in line with its policy of aggressive development, has started work on three additional projects in the northwest end of the field. Nearest to the top of the structure is Webber No. 2, near the southwest corner of section 27, while foundations have been poured for Smith Nos. 2 and 3 in the south half of the northwest quarter of sec. 34,28-25 where Smith No. 1 discovered the subsea top of the zone at 10,895 ft. Superior is also drilling Rudnick No. 1 near the 11,100 ft. mark in the southeast quarter of section 28.

Union Oil Co., sharing development honors with Superior, is drilling two wells in section 34 and has foundations poured for the third active project.

Since the wells completed in this field initial around 3000 bbls. daily of 36 gravity clean oil from 11,400 to 11,500 ft., the indicated additions are no mean asset to California reserves.



A. C. Galbraith, vice-president of Union Oil Co., has been appointed president of the Petroleum Exhibitors, Inc., for 1940. The appointment follows a recent meeting of the executive committee. The Petroleum Exhibitors, Inc., was organized in 1938, to represent the industry at the Golden Gate International Exposition.

Ohio Oil Co. Nears Paloma Field Pay Zone

First company to drill for offset production to the Western Gulf-Texas Co. discovery production in sec. 3,32-26 in the Paloma field is the Ohio Oil Co. Holder of hundreds of acres of leases north and west of discovery acreage, the company located and started drilling KCL No. B-2-43-3, immediately adjacent to the strike.

The Ohio project entered the grey gas cap sand at 10,001 ft., 12 ft. higher than the first well.

Western Gulf Oil Co.'s second well, KCL No. A-74-3, directly east of the original, encountered the top of the zone at 10,083 ft. and with bottom at 10,422 ft. flowed more than an 800-bbl. rate of clean 47 gravity oil along with 35,000,000 cu. ft. gas rate during a formation test. Wishing to adequately test

the sands at this point, Western Gulf has cored ahead to 10,572 ft. at which point recovery was brown shale.

Indicated by discovery points of the three wells, the structural high probably lies somewhere northwest of the center of sec. 3,32-26.

Texas Co. Quits On Second Beer

The second shallow well drilled by The Texas Co. on the large Beer holdings in the Devils Den area has been hung up at 1202 ft. after swabbing only salt water from bottom and fresh water from up hole. Located in sec. 8,26-19, the test was drilled under an operating agreement with the Amerada Petroleum Corp. who has for a long term, held the tremendous Beer leases.

Drilled many times, in many places, the large tract of land is yet considered to afford a good chance at shallow production.

Shallow Gas Sands Blow In Current Valley Wells

After passing high pressure gas sands near the 5000 ft. mark, and successfully cementing an 8510 ft. water string over the main body of the Stevens zone, Richfield Oil Corp.'s KCL-A No. 76-29, suddenly blew out between the newly cemented string and a 1500 ft. surface string. Located in sec. 29,30-25 in the Richfield-Western section of the Cole's Levee field, the well blew gas and mud at an estimated 5,000,000 ft. rate for four days before being killed.

A similar blow-out was experienced in the Rio Bravo field, when Union Oil Co.'s Kernco No. 21-34 spouted while a 7-in. water string was standing cemented at 11,192 ft. In this case also the blow came from the shallow gas zone and blew between water and surface strings.

The potency of Valley shallow gas zones was recently demonstrated, when Richfield Oil Corp. converted its unsuccessful deep oil test at Buena Vista Lake to a 15,000,000 ft. gasser from 5460 ft.

Tide Water To Drill Old East Coalinga Field

Sole active project in the Coalinga shallow area is Tide Water Associated Oil Co.'s Guardian No. 22. Foundation has been poured for the test in the northwest quarter of the northeast quarter of sec. 2,20-15, on the southeast slope of the old Coalinga east side field.

Migs Oil Co. has abandoned its west side outpost, well No. 8, at 232 ft. Located near the south quarter corner of sec. 11,20-14, the try had attempted to extend the small but steady production which the company operates in the southeast quarter of the section.

Cantua Creek Try Drills Kreyenhagen

Continuing a series of tests in the Cantua Creek area of Fresno county in which many large operators engaged, The Texas Co. is drilling S. P. No. 1 near 8000 ft. on sec. 23,17-15. Finding the Kreyenhagen near the 7750 ft. level, the well has encountered the first of the reliable and important geological markers used in the area.

Though drilled in many places to barren Cretaceous in depths ranging down to 10,700 ft., the vast area still offers many undrilled sites which may find commercial production.

Texas Co. Exploring Uncharted Horizons

Drilling a deep test in an area which has never been adequately tested, The Texas Co. is pioneering a promising area near the Fresno-Kings county line. Located in sec. 14,20-18, in what is known as the Huron area, Boston No. 1 was last reported near the 7100 ft. mark in

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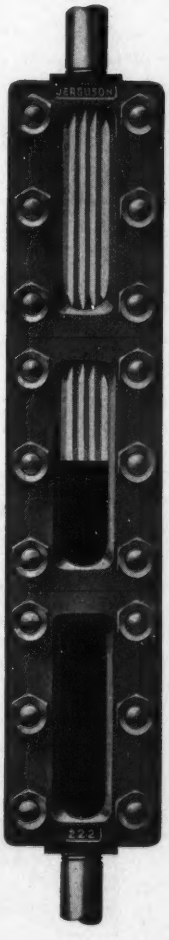

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sandy shale. While nothing has been reported to date, the well is held to offer excellent chances at production from both the Miocene and Eocene formations.

Mendota Test Still Mystery

With adequate geological data unavailable on the Jergins Oil Co.'s Cheney Ranch No. 1 in the Mendota area recent information places the depth at 6500 ft. in what is thought to be Cretaceous shale.

Located in sec. 29,14-13 on a structure indicated by the newly developed method of soil analysis, the well is some 24 miles northwest of Coalinga in Fresno county.

B. V. Lake Oil Hopes Are Dim

Coring meager stringers of oil stained sand in the Stevens near 10,300 ft., Shell Oil Co.'s B.V.A. No. 45-9 in sec. 9,32-25 now presents substantially the same unpromising picture painted by previous drillers. Located at the south edge of the lake bed, the current try encountered the objective Stevens zone only 150 ft. higher than the barren zone found and thoroughly explored by Richfield Oil Corp.'s B.V.A. No. 81-36 at the easterly edge of the lake.

General Petroleum Corp.'s active try, B.V.A. No. 1, located in sec. 1,32-24 between the Buena Vista Hills and the westerly edge of the lake, continues to drill in unpromising formations below 11,250 ft. Top of the Stevens sand was found near the 10,500 ft. mark at this point, and the well to date has yielded nothing of importance.

Development Slack In McKittrick Area

With Calstan Petroleum Co. hanging up Webber No. 1 at 1220 ft. in sec. 34, 30-22, O. T. Deal's M&M No. 1 is the sole active well in the McKittrick district.

Bottomed at 6664 ft. in sec. 30,30-22, the Deal well is cleaning out near the 1400 ft. mark.

Shafter Area Oil Test Nears Potential Horizons

Continuing development of a play long believed to be productive, as evidenced by the participation of many of oildom's large companies, Continental Oil Co.'s Community No. 1 in sec. 12,28-24 is drilling slightly below 9300 ft. Located in the Shafter area, scene of many deep tests, the current well's first encouragement was a little oil and gas on the ditch near the 9000 ft. mark. Bottom, however, is still far above the Vedder zone.

Steve Dunlap Opens New Los Angeles Office

W. E. Dunlap, popular and well known geologist and petroleum engineer, recently established a Los Angeles office in suite 710, Oviatt Bldg., TRinity 4024. Mr. Dunlap has been closely identified with the development of the deep zones at Montebello, having been the first of the profession to realize the big potentialities in the westerly section.

Continental Drills Fast Hole At Wasco

Continental Oil Co. has established an enviable record for fast drilling in its Wasco deep driller, KCL No. A-5 in sec. 8,27-24. In a total lapsed time of 54 days the company made 12,964 ft. of hole in a tough digging area, and cemented a 12,878 ft. protective string of 6⅝-in. pipe. There, gentlemen, is one to shoot at.

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PRODUCTION

(Figures of Production and Stocks are in barrels of 42 Gals.)

	Total Production December	—DAILY AVERAGE— Dec., 1939	Nov., 1939	Dec., 1938
Group No. 1				
Arvin	74,044	2,389	2,543	.....
Belridge—North	365,336	11,785	11,819	12,968
Belridge—South	35,404	1,142	1,140	1,185
Canal	183,591	5,922	5,614	3,893
Canfield Ranch	2,101	68	75	41
Coalinga	657,634	21,214	19,366	9,558
Cole's Levee	57,487	1,854	1,789	179
Edison	68,690	2,216	2,309	2,521
Elk Hills	377,133	12,166	11,351	10,143
Fruitvale	190,340	6,140	6,072	7,376
Greeley	89,220	2,878	2,786	2,208
Kern River	357,358	11,527	11,695	11,319
Kettleman Middle Dome	.....	.....	.....	30
Kettleman North Dome	1,620,892	52,287	51,056	59,867
Lost Hills	104,203	3,361	3,420	3,207
McKittrick	110,076	3,551	3,573	3,479
Midway-Sunset	1,573,853	50,769	49,472	56,769
Mountain View	225,571	7,277	7,359	9,238
Mount Poso	333,391	10,755	10,491	13,808
Paloma	5,386	174	191	.....
Rio Bravo	247,206	7,974	7,918	8,605
Round Mountain	249,096	8,035	8,350	12,795
Strand	35,936	1,159	1,067	.....
Ten Section	258,157	8,328	8,797	8,719
Tupman	31,891	1,029	699	.....
Wasco	34,564	1,115	1,271	633
Wheeler Ridge	10,212	329	330	307
Group No. 2				
Capitan	64,543	2,082	2,159	2,812
Elwood	125,198	4,039	3,970	4,810
Rincon	124,603	4,019	3,738	3,835
San Miguelito	90,829	2,930	2,876	2,489
Santa Barbara	8,311	268	342	420
Santa Maria	458,729	14,798	16,223	15,615
Summerland	825	27	34	24
Ventura Avenue	1,128,945	36,418	36,456	33,908
Ventura-Newhall	210,467	6,789	7,071	5,237
Watsonville	930	30	30	30
Group No. 3				
Brea-Olinda	171,736	5,540	5,607	5,626
Coyote—East	89,896	2,900	2,912	2,758
Coyote—West	193,180	6,232	7,737	8,151
Domingues	585,922	18,901	18,811	24,421
El Segundo	86,239	2,782	2,892	5,009
Huntington Beach	865,559	27,921	27,156	30,659
Inglewood	405,081	13,067	13,085	12,916
Lawndale	1,418	46	47	73
Long Beach	1,374,352	44,334	44,361	51,948
Los Angeles-Salt Lake	16,129	520	550	482
Montebello	839,885	27,093	27,411	16,370
Playa Del Rey	139,325	4,494	4,515	5,538
Potrero	40,351	1,301	1,379	1,012
Richfield	267,822	8,639	8,506	8,208
Rosecrans	310,120	10,004	10,490	14,847
Santa Fe Springs	807,203	26,039	26,581	30,141
Seal Beach	215,916	6,965	7,009	7,822
Torrance	408,120	13,165	13,837	19,221
Whittier	31,179	1,006	931	900
Wilmington	2,635,030	85,001	85,383	92,144
Total	18,996,615	612,794	612,742	646,283
November	18,382,277	612,742		
Increase	614,338	52		

SUMMARY OF CALIFORNIA OILFIELD OPERATIONS FOR DECEMBER, 1939—STOCKS HELD IN PACIFIC COAST TERRITORY BY CALIFORNIA OIL COMPANIES

	Dec. 31, 1939	Nov. 30, 1939	December Changes	Dec. 31, 1938 (Reclassified)
1. Gasoline-Bearing Crude	35,136,501	35,011,252	+ 125,249	36,225,312
2. Non-Gasoline-Bearing Crude	13,303,091	13,654,537	− 351,446	16,282,177
3. Unblended Nat. Gas.	1,516,033	1,652,947	− 136,914	2,699,455
4. Gasoline (not including distributing and service stations)	16,128,052	15,011,338	+1,116,714	13,259,369
5. Naphtha Distillates	1,282,484[1]	1,283,727[1]	− 1,243	1,566,349[1]
6. Gas Oil and Diesel Oil	9,671,299	9,880,120	− 208,821	10,539,937
7. Fuel Oil Residuum	66,886,434	67,437,999	− 551,565	70,957,881
8. All Other Stocks	8,011,354[2]	7,944,532	+ 66,822	6,153,809[2]
TOTAL	151,935,248	151,876,452	+ 58,796	157,684,289
[1]Estimated amount of unfinished gasoline contained in item 5	1,032,536	1,054,145		1,350,379
[2]Coke included in item 8	976,545	859,288		92,066

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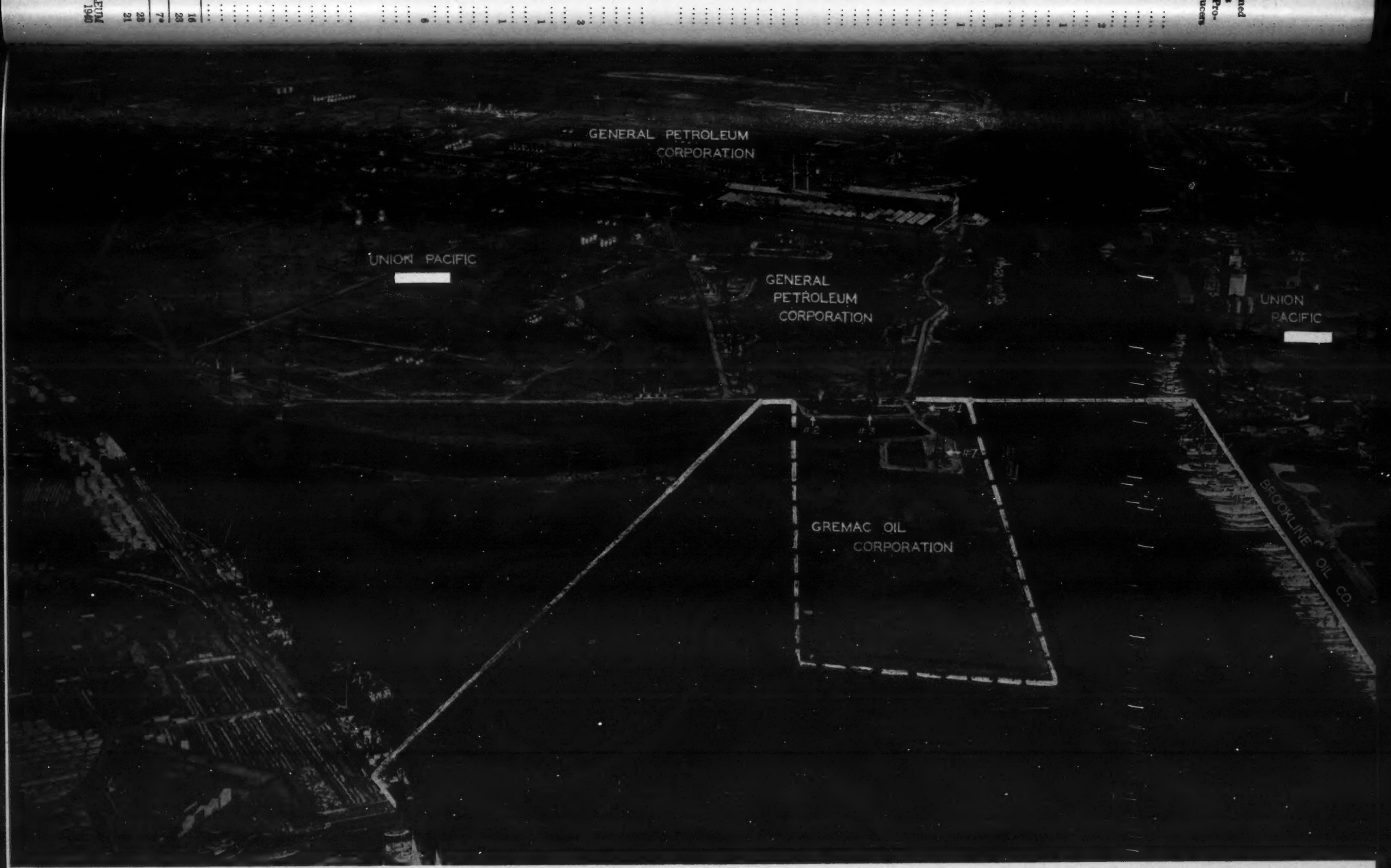
GENERAL ELECTRIC

DEVELOPMENT

	New Rigs Up	Active Drilling	Producers Completed	Daily Initial Output	Active Producing	Abandoned Wells Drillers	Abandoned Wells Producers
Group No. 1							
Arvin	..	1	2	1,453	13	....	....
Belridge—North	..	2	....	....	76	....	....
Belridge—South	..	....	....	....	83	....	....
Canal	2	2	1	2,391	31	....	....
Canfield Ranch	..	....	....	....	1	....	....
Coalinga	8	13	10	26,263	871	2	2
Cole's Levee	1	8	3	2,065	12	....	....
Edison	3	1	1	130	92	....	....
Elk Hills	..	....	....	....	192	....	1
Fruitvale	1	....	....	....	174	1	....
Greeley	3	4	4	9,132	26	....	....
Kern River	3	4	5	101	1,571	2	....
Kettleman Middle Dome	..	....	....	....	....	....	....
Kettleman North Dome		16	6	7,053	243	....	1
Lost Hills	..	....	....	....	290	1	....
McKittrick	..	1	....	....	200	1	....
Midway-Sunset	4	5	3	495	2,572	1	1
Mountain View	..	1	....	....	186	....	....
Mount Poso	..	....	....	....	272	....	....
Paloma	..	2	....	....	1	....	....
Rio Bravo	2	3	1	3,280	38	....	....
Round Mountain	1	....	1	325	206	....	....
Strand	2	2	1	2,090	6	....	....
Ten Section	1	2	2	5,154	31	....	....
Tupman	3	3	1	1,725	5	....	....
Wasco	1	3	....	....	7	....	....
Wheeler Ridge	..	....	....	....	33	....	....
Group No. 2							
Capitan	..	....	....	....	45	....	....
Elwood	..	....	....	....	81	....	....
Rincon	1	2	....	....	54	....	....
San Miguelito	..	2	....	....	21	....	....
Santa Barbara	..	....	....	....	27	....	....
Santa Maria	4	3	1	5,000	270	....	....
Summerland	..	....	....	....	17	....	....
Ventura Avenue	4	10	7	9,703	275	....	....
Ventura-Newhall	1	8	2	27	552	....	....
Watsonville	..	....	....	....	7	....	....
Group No. 3							
Brea-Olinda	..	....	....	....	356	....	....
Coyote—East	1	2	....	....	78	....	....
Coyote—West	..	....	....	....	60	....	....
Domingues	3	2	3	2,334	170	....	....
El Segundo	..	....	....	....	47	....	....
Huntington Beach	2	3	1	509	529	....	3
Inglewood	..	....	....	....	208	....	....
Lawndale	..	....	....	....	5	....	....
Long Beach	1	2	5	700	1,210	....	1
Los Angeles-Salt Lake	..	....	....	....	111	....	....
Montebello	11	22	19	7,501	340	....	....
Playa Del Rey	..	....	....	....	160	....	1
Potrero	..	2	....	....	16	....	....
Richfield	1	2	....	....	304	....	....
Rosecrans	5	7	1	160	138	....	....
Santa Fe Springs	..	....	....	....	565	....	....
Seal Beach	2	2	1	156	118	....	....
Torrance	..	1	1	150	699	....	6
Whittier	1	1	....	....	144	....	....
Wilmington	14	13	16	5,592	759	....	....
Miscellaneous Drilling	9	27	....	....	....	14	....
Group No. 4—Gas Fields							
Buena Vista Lake	..	....	....	....	4	....	....
Buttonwillow	..	....	....	....	20	....	....
Chowchilla	..	....	....	....	....	....	....
Delano	1	2	1	Gas	9	....	....
Dudley Ridge	..	....	....	....	....	....	....
Fairfield Knolls	..	....	....	....	....	....	....
Goleta	..	....	....	....	....	1	....
Marysville Buttes	..	1	....	....	3	....	....
McDonald Island	..	....	....	....	5	....	....
Rio Vista	..	....	....	....	22	....	....
Semi-Tropic	..	....	....	....	2	....	....
Tracy	..	....	....	....	5	....	....
December	104	187	99	93,489	14,668	23	16
November	85	206	85	73,043	14,510	16	23
Increase (*Decrease)	19	19*	14	20,446	158	7	7*
Average for year 1939	91	191	72	64,552	14,188	21	23
Average for year 1938	96	207	83	76,738	13,621	22	21



This aerial photograph, looking eastward from a point over the East Basin of Wilmington, illustrates positions of various companies in the southwest section of California's heaviest producing field Most easterly in the line of re-touched derricks on General Petroleum property paralleling Cerritos Channel is the discovery well, Terminal No. 1. In the foreground is the marsh land being developed by Gremac Oil Corp. where roads and drill sites must be filled with many cubic yards of earth. This 14 acre tideland will eventually provide surface locations for many wells whipstocked under the company's 87 acres of Banning and L. A. City Harbor Dept. leases indicated by the white lines.

Los Angeles Basin

Inglewood Deep Test Will Soon Be Drilled

One of the most momentous wells in the Los Angeles Basin will soon be drilled in search of Miocene production at the northerly tip of the Inglewood or Baldwin Hills field. Based on geology and engineering work by W. E. (Steve) Dunlap, the deep test will be located on property belonging to Ron Smith of the H. C. Smith Oil Tool Co. and will be drilled by B. H. Extension Co. which has been formed for the purpose by O. J. Rohde, Sam Brooks and Sam Bennett.

The entire district is under lease at present, B. H. Extension Co. holding a total of 130 acres of choice land while other large and favorably located parcels are held by Hogan Petroleum Co. and others. The shallow production in the field is held exclusively by major companies.

Near the site chosen for the new test, Plymouth Oil Co. some years ago drilled to 5600 ft. finding the top of the Puente (Upper Miocene) at 5525 ft. The 75 ft. interval immediately above bottom contained a high percentage of oil sand but a production test failed when water broke in due to failure of a "c.p." job.

Although the old well cored fair looking oil sand from 3960 to 4040 ft.., B. H. Extension Co. (the "B.H." stands for Baldwin Hills) will not test the zone in its first well but will carry on in search of production in sand sections equivalent to the 7th and 8th Callender zones of Dominguez, where the top of the Miocene is encountered nearly 1000 ft. lower.

The men behind the new well are widely known in the oil business; Messrs. Rohde, Bennett and Brooks being among the most successful Montebello operators while Mr. Dunlap fathered the deep west end field by mapping the structure a year before the first test well was drilled.

According to Mr. Dunlap, Baldwin Hills is the only major Los Angeles Basin oil field which at present does not produce from the Miocene.

Shallow Zones Steal Wilmington Spotlight

The shallow zones stole the show at Wilmington during the past fortnight by producing two 600 bbl. wells at opposite ends of the field.

In the Long Beach Harbor area, Continental Corp. finished its first Flood Control Channel well, No. 2, flowing at the rate of 628 bbls. per day from 390 ft. of Ranger zone open to bottom at 2981 ft. Typical of the Ocean Blvd. sector, gravity of the oil was 17.6 degrees, API.

In the extreme northwesterly townlot area, Wilton Oil Co. brought in No. F-55-10 flowing at a 620 bbl. rate. A total of 530 ft. of perforated intervals is open between the shoe of the water string at 2988 ft. and bottom at 3696 ft. The project is located south and west of the intersection of "L" and Marine Sts.

Union Pacific's No. 130 on Terminal Island was completed in the Upper Terminal zone at 3477 ft. flowing 962 bbls. of 25.5 gravity clean oil while Royalty Service's redrilled Chadwick No. 1 came in for nearly 400 bbls. from 3600 ft. and General Petroleum's Blinn No. 8 in Long Beach Harbor initialed 100 bbls. from 3350 ft.

In the process of completing at press time were Ace Oil Co.'s Sweitzer No. 1 in the northerly Long Beach section, Hansen Oil Corp. No. 1 in the Harbor area and two Union Pacific wells.

Rolling Hills Well Finds Shoe Test Wet

Rolling Hills Petroleum Co. tested the entire open interval below the shoe of the 4¾-in. casing at 6470 ft. but recovered only unset cement and mud in the testing tool. Hole had been cleaned out to bottom at 6580 ft.

According to Superintendent McClaren the well will be recemented an another production test made.

Consolidated Well Swabs Green Oil

Consolidated Oil Co.'s Needham No. 4, by swabbing green oil, has suddenly become one of the most interesting wells in the Newhall area. Bottomed in Eocene sand at 4300 ft. and with hole barefoot below the casing shoe at 4028 ft., tubing was run and the well swabbed for several days during which the fluid changed rapidly from drilling water and mud to a light, greenish colored 33 gravity oil. As porosity and permeability of the oil sand were considered too low

LOS ANGELES BASIN WILDCATS

Area	Well	No.	Section	Depth	Status
Athens	El Rey Oil Co., Westmore	1	2, 3-14	7050	Drilling
	Melrose Pet. Co.	1	12, 3-14		Rig
Castaic	Lang, Ed. W., Rupy	1	7, 5-16	665	Drilling
	Pedro Pet. Co., Oates	1	24, 5-17	30	Technical spud
	Worland, C. C., Jenkins-Owens	1	18, 5-16	1950	Idle
Chatsworth	Fernando Oils, Ltd., Holmes	1	18, 2-16		Grade
Inglewood	Vanguard Oil Co., L.A.I.	1	29, 2-14		Rigged up—Idle
Mint Canyon	Redwood Oil Co., Mitchell	2	22, 4-15	525	Idle
Newhall	Canyon Oil Co., Sanborn	1	6, 3-16		Rig
	Consolidated Pet. Co., Needham	4	13, 3-16	4300	Swabbing
	Hazard Oil Co.	1	1, 3-16	2306	Idle
	Mangrum and Page, Lintz	1	4, 3-15	852	Idle
	Tamas Oil Co., Perkins	1	11, 3-16	3920	Stdg. Cem.
Palos Verdes	Rolling Hills Pet.	1	27, 4-14	6580	Prep. to Test
San Fernando	Continental Oil Co., Howell	1	2, 2-16	2580	Drilling
Sunland	Casa Grande Oil Co.,Lopez-Lundy	1	1, 2-15	2320	Bailing
Torrance	Dominguez Estate Co., Fee	1	2, 4-14	5899	Drilling
West Whittier	West Whittier Oil Co., Pellissier	1	17, 2-11	4400	Running casing
	Orange County				
Costa Mesa	Thompson, Milton N., Banning	1	9, 6-10	4360	Drilling
Olive	Jenkins, H. H.	1	17, 4-9	600	Idle
Yorba Linda	Morgan, George, Fricke	1	21, 3-9	2145	Pumping 50 bbl.

NORTHERN COUNTIES WILDCATS

County	Well	No.	Section	Depth	Status
Contra Costa	Tassajara Oil Corp.	1	9, 2s-1e	8431	Drilling
Humboldt	The Texas Co., Holmes-Eureka	1	22, 3n-1w	4850	Compl. gasser
Monterey	Loma Grande Oil Co., Corey	1	23, 24s-10e		Location
	Priest Valley Pet. Co., Greve	1	22, 20s-12e	2040	Cleaning out
Sacramento	Amerada Pet. Corp., Carpenter	1	20, 4n-3e		Grade
	Superior Oil Co., Larsen	1	17, 3n-3e		Location
Solano	Richfield Oil Corp., Potrero Hills	2	5, 4n-1w	1758	Reaming
Sutter	Buttes Oilfields, Inc., McPherrin	6	1, 15n-1e	7075	No report

for production, the well is attracting a lot of attention from core experts and laboratory men.

Swabbing caused the hole to bridge at 4000 ft. and the tubing is being pulled to clean out and deepen to the base of the sand before making another production test.

Needham No. 4 has penetrated the geological column farther than any other well in the Newhall area and is being watched closely by Tide Water Associated Oil Co., The Texas Co., Barnsdall Oil Co., General Petroleum Corp. Shell Oil Co. and Standard Oil Co., all of which hold leases within a radius of a few miles.

Montebello Deep Test Looms In Near Future

The long awaited deep test for a Ninth Montebello zone will probably become a reality within the next week or two, judging from all signs.

Robert A. Berkey, president of Mono Oil Co. is negotiating with other operators for aid in deepening his advantageously located Mono No. 1 which is just north of Beverly Blvd. and west of Maple Ave. Should this deal fail to materialize, one of the Rohde companies will probably deepen.

With the bottom of the hole hopelessly junked, C. A. P. Oil Co. has plugged its No. 1 well to 6850 ft. where a completion will be attempted in the Masser zone. A fair well should be obtained as this horizon has been somewhat neglected in the rush to develop the Eighth zone.

Columbia Oil Co. is completing Crawford No. 19 as an offset to Dutch Petroleum Co.'s Schelnik No. 1 south of Beverly and east of Wilcox. The hole was bottomed at 7656 ft. and is perforated at intervals below 7460 ft.

Westmont Oil Co.'s Brown No. 1, drilled by Gus Pongratz, was completed flowing 450 bbls. a day rate of clean 35 gravity oil. The well is one of the southerly line of producers west of Maple Ave. President M. J. Koppel plans to drill another well on the property adjoining to the east.

West of the Westmont well, Stag Oil Co. finished its Brown No. 1 at 7617 ft. flowing an estimated 500 bbls. a day. Like all wells in the field, production has been cut back to comply with state regulations.

The J. E. Mabee Co. has the distinction of being the only operator in the field running two strings of tools. On leases from Kern Oil Co., the company is drilling Mulholland No. 6 at 6450 ft. and Monterey No. 39 at 5000 ft.

Shore Line Drilling Corp. No. 1, located at 10th St. and Harding, is completing at 7590 ft.

Drilling activity throughout the field is generally lower, there being only 15 wells in drilling and completing stages. Only new company formed for drilling is Grace Oil Co., headed by E. G. de Staute and Tom Ferguson, which will offset Caminol's No. 3-17 and No. 4-20 near the intersection of Beverly and Wilcox.

Dominguez Outpost Gets Ditch Shows

Gus Pongratz Oil Co. Grant No. 1, westerly Dominguez outpost, seems destined to become one of the important wells of 1940. Now drilling near 6800 ft., the project has had almost continuous showings on the ditch since passing the 5700 ft. level. The operators plan to run an electric log soon for a check of the uncored showings. The well seeks production in the 7th Callender

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zone which should be encountered near 7000 ft.

'Busiest section of the field is the former western frontier at Avalon Blvd. where Union Oil Co. has two rigs working and Russ Havenstrite one. A quarter of a mile to the south, Seaport Oil Corp. has derrick up for Dasteel No. 1 at the southwest corner of Victoria Ave. and Avalon Blvd.

Morton and Elder are testing reportedly doubtful sands in Stabler-Dominguez No. 2 at the east end of the field. The old hole was deepened to 7430 ft.

United Builds Derrick For Orange County Test

United Oil Co., newly formed by R. W. (Rocky) Jerman of Signal Hill deep zone fame, has derrick erected for a promising wildcat venture at the southerly outskirts of Stanton in Orange county. Located 1350 ft. south of Katella St. and 150 ft. east of Stanton Blvd., the project is ten miles north of Huntington Beach and five miles southwest of Anaheim.

Mr. Jerman, who will be in personal charge of the drilling, believes production may be found at relatively shallow depths in either or both the Repetto and Puente formations which are prolific at Signal Hill and Huntington Beach.

No wells have been drilled in this immediate vicinity, but several tries toward Anaheim encountered oil showings without locating a structure.

Athens-Potrero Test Nears Critical Stage

El Rey Oil Co.'s wildcat at the northwest corner of Western Ave. and Imperial Highway is approaching its most interesting and critical stage. When last reported bottom was at 7200 ft., and though detailed information was not available, seemingly authentic sources credited the project with some oil showings.

The big butane outfit, on its maiden voyage as it were, is performing very well, according to contractor J. E. Pettijohn, and it is planned to carry the hole to at least 8500 ft. to thoroughly test the 7th and 8th Callender zone equivalents in the Miocene.

Huntington Test Drills At 7600 Ft.

Having encountered no encouragement so far, South Basin Oil Co.'s Huntington Beach deep test, No. 93 is drilling at 7600 ft. The well is said to be following a hunch of the late J. B. Dabney that deep production exists in the easterly section of the old field.

Southeast of the South Basin well, H.R.O. Oil Co. is drilling its semi-wildcat at 4350 ft. Several good ditch shows have been noted.

In the Five Points area, W. T. Ball is making a pump test of Harper No. 1, drilled by Apex to 5436 ft. and plugged back by the present operator to 4125 ft. No estimate of the yield has been received.

M.K.F. Oil Co.'s No. 1 was redrilled to 3200 ft. and completed with initial rate of production placed at 75 bbls. a day.

West Whittier Well Shows Oil and Gas

West Whittier Oil Co.'s Pellissier No. 1, attempting to inject new life into the old West Whittier field, swabbed considerable oil and gas on a test of perforations in the 6⅝-in. casing at 3115 ft.

The well was drilled to 4400 ft. finding no encouragement below the Whitely zone and was plugged to 3400 ft. where the casing was cemented. It is planned to gun-perforate the old producing horizon of the field after obtaining a satisfactory water shutoff.

Apex Pet. Tests Rosecrans Well

Apex Petroleum Corp. is preparing to gun-perforate and test Hatfield No. 1 in the southerly extension area of the Rosecrans field. Casing was cemented on bottom at 9000 ft. and holes will be shot opposite points picked from cores and the electric log.

Just west of the Apex well, Dr. Averill installed a pump in his jinx No. 3, and was rewarded with an output estimated at 50 bbls. a day. The hole is bottomed at 8405 ft.

The area's easterly outpost, Barnsdall-Wilshire's Santa Fe Corp. No. 1, is flowing 45 bbls. of 35 gravity oil cutting 30.0%. The casing is gun perforated at intervals below 8300 ft.

In the southerly section of the main Rosecrans field, St. Anthony Oil Corp. is coring Gordon No. 1 below 7000 ft. and will soon set casing over the O'Dea zone. In the same area, Union Oil Co. finished Rosecrans No. 37 flowing 225 bbls. from 7700 ft.

Aliso Deep Test Cores Gray Sand

Porter No. 12, Tide Water Associated's Aliso Canyon deep test, is reported to be coring gray sand at 7900 ft.

SUNSET OIL COMPANY

Announces

A NEW CONTRACT DRILLING DEPARTMENT

2 POWER RIGS

RIG No. 7 POWERED WITH a *WAUKESHA GAS-BUTANE ENGINE.* RIG No. 9 POWERED WITH a *CUMMINS DIESEL ENGINE.*

These rigs are especially adaptable for operations where the installation of a boiler plant is costly, or gas and electricity are not available. Both rigs are equipped with electric generating equipment. Either rig is recommended for 8000 foot drilling with the use of 4½" drill pipe.

The Sunset Oil Company, *fully covered in its operations with all types of insurance,* will contract with operators on a per foot or a per day basis.

For economical performance let Sunset bid on your next drilling job... call Geo. H. McCarthy, Vandike 1271... or write

SUNSET OIL COMPANY

988 Pacific Electric Building

Los Angeles, California

It is planned to carry the hole through the Miocene if possible.

Location for Porter No. 15 is being graded while No. 22 is rigging up and No. 13 is drilling at 650 ft.

Since the discovery of oil in Eocene sand by Consolidated Petroleum Co.'s Needham No. 4, rumors have circulated that either Standard or Union will re-enter and deepen its abandoned well north of Tide Water's production.

Yorba Linda Well Pumps 50 Bbls. a Day

George Morgan, drilling the first new well at Yorba Linda in two years, obtained a yield of 50 bbls. a day on the pump. Located just south of the famous Shell core hole that flowed at a 1600 bbl. rate, the project was bottomed at 2145 ft. and finished with 150 ft. of sand open. The oil tests 14 gravity and cuts 10.0%.

Continental Holds Fernando Interest

Much interest is being evidenced in Continental Oil Co.'s Reservoir Anticline wildcat in the westerly section of the San Fernando Valley. Now drilling below 2700 ft., the well has encountered much low grade oil sand in Saugus formations below 1650 ft. Two runs of a formation tester were failures due to caving shoulders.

Sonwell Proposes 2nd Coyote Well

Sonwell Oil Co. is preparing to drill its second northside outpost well in the East Coyote field. Its first attempt last fall was finished with a 100 bbl. clean oil yield.

In the old section of the field, Mojave Petroleum Co. acquired Century Oil Co.'s Tuffree No. 1 which it is deepening.

Pepper Drive Well Pumps 190 Bbl. Rate

Pumping at a 190 bbl. rate, D. D. Dunlap's No. 14 was completed as one of the best producers in the Long Beach Pepper Drive boom. A "grass-roots" job, only 20 days were required from the time the kelly started turning to the right until the oil was in the tanks. Hole was bottomed at 3875 ft. and the 8⅝-in. water string was cemented at 3617 ft. Gravity of the oil, which cuts less than 3.0%, is slightly over 23. No. 14 is located in the northwesterly section of the little hot spot.

Graham-Loftus Oil Corp. are attempting to extend the zone to the south on American Ave. with Dodge No. 2 which is testing after cementing casing at 3420 ft.

Thos. W. Simmons Purchases Butler Sump and Tank Service

The business, equipment and goodwill of the Butler Sump & Tank Service has been purchased by Thos. W. Simmons, well known oil man.

While present equipment affords a clean, swift and inexpensive tank cleaning, Mr. Simmons will soon add new improved equipment and added facilities to the present service.

Business will be conducted from Mr. Simmons present offices in the Richfield Building at Los Angeles, under the name of Thos. W. Simmons, Tank Service Division.

You are reading the Pacific Coast oil men's home paper.

SPEED UP DRILLING
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POWER, TIME
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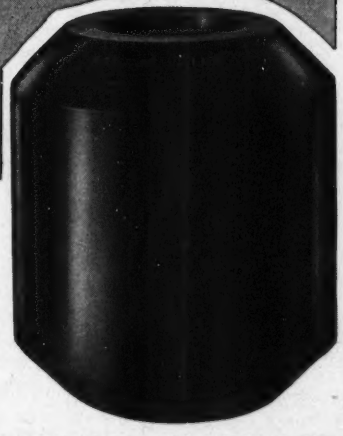

Casing isn't intended to be a bearing for a revolving tool joint, but it makes a fine, frictionless housing for a mud-lubricated P-B Protector. Both casing and tool joints are saved, more power available at the drill, the drill goes faster and the well is completed in less time, at less cost.

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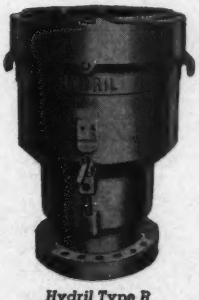
Oil production men know what a Blowout Preventer has to be ready to stand. Extremely high pressures and sudden shattering shocks must be instantly and positively resisted.



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Vision of these needs, plus years of research and experience in making steel castings for hard jobs, have enabled our metallurgists and skilled workers to produce castings for HYDRIL Blowout Preventers that are uniformly reliable under emergency conditions.

This reliability is pre-proved under full test pressure at the completely equipped drilling rig in the testing department of the HYDRIL Company at Torrance, where field conditions are duplicated.

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Los Angeles

LOS ANGELES
STEEL CASTING CO.

Coastal District

Cal. Alliance No. 2 Ventura Disappointment

Somewhat disappointing to Ventura Avenue observers was California Alliance's Hartman Ranch No. 2 when it found only stringers of oil sand at the top of the Hisey zone at 7432 ft. Hole is being deepened to test the "57" zone.

Lending encouragement to northside operators, Shell Oil Co. brought in Edison No. 35 flowing 1200 bbls. of 31 gravity clean oil and more than 1,000,000 cu. ft. of gas. The liner is perforated at intervals from the water string shoe at 7970 ft. to bottom at 9135 ft.

Tide Water Associated Oil Co.'s Lloyd No. 120 was completed flowing 950 bbls. from 600 ft. of formation open to bottom at 9200 ft. Gas production was 1,600,000 cu. ft. per day.

British-American Oil Producing Co. is deepening its No. 9 on Bolsa Chica Oil Corp.'s Hartman lease.

Texas Finishes Humboldt Well

The Texas Co. recently finished its fourth Humboldt county well as another big gasser. Located approximately 20 miles south of the city of Eureka, the latest project, Holmes-Eureka No. 1 was bottomed at 4850 ft. with nearly 1100 ft. of formation open below the shoe of the 7⅝ in. water string. Plans for another well in the area as yet are only tentative.

Conejo Well Below 1300 Ft.

Sulphur Springs Oil Co. is drilling its Janss No. 1 at Conejo below 1300 ft. according to advices received from the company's Los Angeles headquarters. Vaqueros sand is said to have been encountered at 600 ft.

Holly To Drill At Pismo Beach

One of the most interesting of recent coastal district wildcats will soon be started by Holly Oil Co. on the Meherin property a mile north of Pismo Beach in San Luis Obispo county.

According to company engineer Bill Comstock, production will be sought in the Santa Margarita above 3000 ft. The structure is said to be an untested anticline offering very good potentialities.

The Hall-Baker Co. of Los Angeles has contracted to drill the hole with a portable rotary rig.

Bell Corp. Plugs Well At Lompoc

Alphonzo E. Bell Corp. is plugging its No. 1 well at Lompoc to perforate casing in the interval between 1830 and 1930 ft. The well is an old producer formerly completed at 3000 ft.

Hamilton Well Tested All Wet

W. C. Hamilton recovered only water with slight oil colors on a swabbing test of his Hollister No. 1 at Goleta.

Preparations are being made to deepen below present bottom of 1185 ft.

Union Oil Completes Santa Maria Producer

Union Oil Co. added another big well to its long list of Santa Maria Valley producers when O'Donnell No. 2-4 was swabbed in flowing 800 bbls. a day. Approximately 300 ft. of Monterey oil zone is open below the shoe of the 8⅝ in. casing at 4950 ft. Top of the Franciscan schist basement is placed at 5249 ft.

Russell - Lollier No. 1, Union's other recent completion, is now on the beam with production estimated at 100 bbls. The well makes considerable sand, and requires occasional cleaning out.

San Miguelito Well Flows At High Rate

Continental Oil Co. brought in Grubb No. 13 at San Miguelito as one of the largest wells in the state; initial estimates running as high as 5000 bbls. a day. On settled production through two 48/64 in. beans, production gauged 2695 bbls. of oil; 2350 mcf of gas.

Seven inch casing was cemented at 5400 ft. and a perforated liner was landed on bottom at 6720.

Trans-Oceanic Plans Redrilling No. 5

After finding the main body of Vaqueros sand barren in M'divani No. 5 at Santa Barbara Mesa, Trans-Oceanic Oil Co. is said to be planning to redrill in hopes of finding better saturation. The most southerly of five in a row running toward the ocean from Mesa Drive, the project encountered the Vaqueros at

COASTAL COUNTIES WILDCATS

Area	Well	No.	Section	Depth	Status
Santa Barbara County					
Betteravia	Union Oil Co., Pezzoni	1	33, 10-35		Location
Carpinteria	Sunset Oil Co.	1	32, 4-25	3413	Idle
Goleta	Hamilton, W. C., Hollister	1	3, 4-29	1184	Prep. to deepen
Lompoc	Alphonso E. Bell Corp.	1	33, 8-34	2997	Plugging
	Sun-Bell Drilling Co.	1	28, 8-34	2982	Idle
Los Olivos	United Western Oil Co.	1	15, 7-30	3927	Redrilling
Orcutt	Arnold Oil Corp., A-A	2	8, 8-33	6825	Idle
Summerland	Oil Group, Inc., Hyland	1	16, 4-26	1350	Idle
San Luis Obispo County					
Arroyo Grande	Holly Oil Co., Meherin	1	7, 32-13		Portable Rig
Elk Horn	Calif. Pet. Prod., Irons	1	19, 10-24	2527	Idle
	Burrhus, V. E.	1	8, 32-22	60	Idle
	Burrhus, V. E., Haberkern	1	21, 32-22	2160	Drilling
	Newton Dev. Co.	1	3, 32-21		Rigging up
Huasna	Gilmore Oil Co., Huasna Comm.	1	11, 32-14		Grade
Paso Robles	Epco, Inc.	1	27, 26-13	6157	Idle
Ventura County					
Conejo	Sulphur Springs Oil Co., Janss	1	33, 2-19	1550	Drilling
Moorpark	Shafer, Frank, et. al.	1	30, 3-19	736	Idle
Ojai	Coronet Oil Co., Coronet	4	17, 4-21	1165	Pumping water
Santa Susana	K. C. Oil Co., Marr	1	32, 3-17	1014	Idle
Sespe	Brain, Phillip, Cosby	1	14, 4-19	1120	Idle
	English, J. A., Lankershim	2	13, 4-19	2502	Pumping water
	G. E. Development Co.	7	13, 4-19	235	Drilling
	Hall, Henry Lynn, Tar Creek	1	35, 5-19	1275	Idle
	Renard Oil Co.	1	6, 4-19	1100	Idle
Shiells Canyon	Galveston Oil Co.	1	5, 3-19	3140	Idle
Simi	Levesque, G. M., Robertson	1	17, 2-18	2250	Repairing Rig
	Ohio Oil Co., Vail	1	10, 2-19	3300	Drilling
South Mountain	Albatross Oil Co., Schiefferle	1	17, 3-20		Rig
	Mallon, Felix, Richardson	1	14, 3-21		Rig

1635 ft. and the Sespe at 1835 ft., finally bottoming at 2020 ft.

Only other activity in the entire field is the occasional abandonment of one of the old producers in the westerly section of the area.

Old Shiells Well Pumps 150 Bbl. Rate

Deepened to 4016 ft., Calumet No. 8 of Savage Oil Co. is reported to be pumping approximately 150 bbls. a day of 33 gravity oil cutting 7.0%. The well is an old shallow zone pumper which was carried down in search of deeper production.

Dr. Kemnitzer Opens Consulting Office

Dr. Luis E. Kemnitzer, who recently resigned as chief geologist of The Petrol Corp., has established a general petroleum geology and engineering consulting office at 1118 Financial Center Building in downtown Los Angeles.

Dr. Kemnitzer has a background unusually rich in both theoretical and practical training. Graduating from Stanford University School of Geology in 1925, he obtained employment as a mining engineer which took him to Mexico and South America. Returning to the United States, he accepted a position in the geology department of Shell Oil Co., Inc. which he left in 1930 to take advantage of an opportunity to do field work in Canada and Germany for Cities Service Co. In 1933 he received his Masters Degree from California Institute of Technology which was followed in two years by a Ph.D. from the same school.

In 1935 Dr. Kemnitzer began his association with The Petrol Corp., whose geological work he still handles on a retainer basis. During this period it was necessary for him to study at first hand practically every producing and potentially producing area in California, giving him a broad and thorough working knowledge of the entire state.

By his many friends he is called Lew, and is known for his skill with a camera.

C.N.G.A. Mourns Ben Koehler Death

Ben A. Koehler, one of the pioneer members of California Natural Gasoline Association dating back to 1927 died on Jan. 22. First as a member, and later as a director of C.N.G.A. Mr. Koehler gave willingly of his time and energies to build the Association and maintain its enviable position in its field.

He was a graduate in geology and petroleum engineering of the University of Washington and served in the air corps during the World War. His first oil experience was with the Petroleum Midway Oil Co.'s geological department. He joined the Getty organization in 1921 as superintendent of the gasoline division and built the first gasoline plant at Santa Fe Springs for the Sandoma Gasoline Co., a subsidiary. At the time of his death he was superintendent of the Getty-Pacific Western Oil Co. natural gasoline department.

The directorate and membership of California Natural Gasoline Association feel a distinct loss in the passing of Ben A. Koehler, their friend and fellow worker.

Globe Oil Tool Head To Visit South America

Advice just has been received from E. M. Smith, President and General Manager of Globe Oil Tools Co. of Los Nietos, Calif., that he will leave shortly via

E. M. Smith

Pan-American Airways for an extended tour of all South American countries in which oil development now is in progress.

Mr. Smith states that his itinerary includes Trinidad, Colombia, Peru, Argentina, Brazil, and Venezuela, and that he plans to spend some time in practically every active oil district on the South American continent. He expects to reach Buenos Aires during the early part of April, where he will remain for ten days or two weeks. The trip will consume several months time, much of which will be in direct contact with drillers and field men for the purpose of acquainting them with various new Globe tools, as well as recent improvements in various other items in the extensive line of drilling and reaming tools.

"E. M." is well known to oil men in all parts of the world through more than twenty years of activity in the oil tool manufacturing industry, during which time he founded the Emsco Derrick & Equipment Co. and various other Emsco companies. The Globe company also is known throughout the oil fields of the world, where its products have been in constant use for a long period of years. Recently the company announced the appointment of B. E. Johnston as direct factory representative in South America, who already has sailed to take up his duties there.

Macwhyte Co. "Partners" Celebrate 50th Year

George S. Whyte, familiarly known to his many business friends as Sandy Macwhyte, and his "guid" wife recently celebrated their Golden Wedding Anniversary. Mrs. Whyte, as beloved by all employes of Macwhyte Co. as her "partner," Sandy, invited all company employes and their wives to an informal dinner, and arranged an excellent program in which employes took active part, and over 650 pairs of feet gathered together at the festive board.

It is truthfully said that this festive occasion celebrated not only fifty years of a happy married life but years of helpful cooperation together to build a company of the better kind with fair and impartial consideration for all.

When Sandy, "The Grand Old Man", passed his three score and ten mark three years ago, the employes presented him with a bronze plaque on which was engraved all their facsimile signatures.

On the occasion of their Golden Wedding Anniversary, the employes again showed their love and appreciation by presenting to Mr. and Mrs. George S. Whyte a handsome Grandfather's Clock on which was an engraved gold plate reading—

"Presented to Mr. and Mrs. George S. Whyte on their Golden Wedding Anniversary by the Macwhyte employes February 15, 1940."

Mr. Whyte, now Chairman of the Board of Macwhyte Co., is very active in the affairs of the company. His pleasing personality and homely philosophy have kept him endeared to the hearts of his many friends from the days he labored in the coal mines of Scotland at $1.00 a day through all the intervening years.

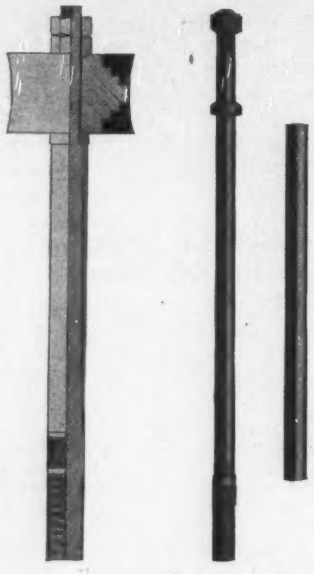
Of course there has always been harmony—employes are friends in this company.

Almost simultaneously with the Anniversary Dinner of Mr. and Mrs. Whyte, the Macwhyte Co. announces the appointment of Associated Piping & Engineering Co., Ltd., as exclusive California oil industry distributors.

George Humiston, president of Associated Piping & Engineering Co., Ltd., states that O. B. Kible, formerly sales manager of Regan Forge & Engineering Co., will head their new wire rope sales division. Mr. Humiston also advises that stocks of all sizes of the Macwhyte line will be carried.

Replaceable Sleeve Type Piston Rod By Regan

To eliminate the necessity of replacing the entire rod assembly in a piston pump after the rod wears down, a new replacement type has been developed by Regan Forge & Engineering Co. It



is a sleeve type, providing the use of a sleeve around the rod. Instead of wear being imposed on the rod proper, the wear occurs upon the sleeve, which is a cheaper element and can be most economically replaced. The entire assembly consists of a Rod, Wear Sleeve, Universal Sealing Ring, Universal Nut and Jam Nut. With this construction it is possible to uniformly heat treat the rod member, to obtain maximum physical properties for increasing strength and to resist fatigue. The sleeve member is also heat treated. Distortion and warpage are reduced. The sealing ring and nut are precision made of a material with proper ductility to effect and maintain a fluid-tight seal. The wear sleeve is slightly longer than the mating portion of the rod, providing a slight overhang of the wear sleeve for sealing engagement with the sealing ring. These replaceable rods are furnished in all sizes to fit all makes of piston pumps, and are furnished with A.P.I. taper or Universal ends. Full details may be obtained by addressing Regan Forge & Engineering Co., P. O. Box 150, San Pedro, Calif.

Lunkenheimer "King-Clip"

This new 8 page circular in two colors shows the complete line of Lunkenheimer "King-clip" Valves with drain channels and bronze thread bushing in bonnet. Valves are available in iron body with bronze trim for steam, oil, gas, air, water and gasoline service and with various alloy trims for corrosive services.

The Lunkenheimer Co., Cincinnati, Ohio.

Merco Appoints New Distributor

The appointment of Oilwell Chemical and Materials Co., Inc., of Bakersfield, Calif., as sole distributors for the new

Edward Sam Self

Merco Type A-24 Concentrator and the Merco Type A-24 Desander has just been announced by Clarence J. Brown, Vice President of the Merco Centrifugal Co., San Francisco, Calif. The Merco Type A-24 Concentrator has been designed, engineered and perfected for the economical conservation of weighting material in rotary drilling mud.

The Oilwell Chemical and Materials Co., Inc. and its sales and engineering staff are under the active direction of Mr. Edward Sam Self, President. A complete testing laboratory and field testing facilities are maintained to render practical service to drilling operators everywhere in California. Warehouse facilities are maintained in all California oil fields for serving and supplying drilling operators.

Having pioneered in the sales, supply and service of rotary drilling mud materials in California, the Oilwell Chemical and Materials Co., Inc., with their vast experience, are exceptionally well qualified to be of assistance in answering the perplexing mud problems which are encountered in every day drilling. With their appointment as distributors for the new Merco Concentrator, as well as the Merco Desander, this organization is in splendid position to render further assistance in solving mud problems in the California oil fields.

Ohio Vail Cores Sespe

Ohio Oil Co.'s Vail No. 1, located in sec. 10,2-19 in the Simi Valley, is drilling below 3300 ft. in Sespe formation. Only occasional cores have been taken.

An International building, shown above in the artist's drawing, is planned for the 1940 International Petroleum Exposition to be held in Tulsa May 18 to 25. In this building governments of the world are invited to exhibit bass relief maps of their country's oil fields, and the building will be used as a meeting place for international delegates.

Union Oil Holds Lube Sales Convention

Delegates, representing Union Oil Co.'s far-flung marketing territory from Alaska to Panama converged on San Francisco to attend the company's 1940 Lubricating Sales Engineers Convention,

R. Cubicciotti, manager of lubricant sales for Union Oil Co., who presided at the company's 1940 convention of Lubricating Sales Engineers, in San Francisco, February 12-15.

Feb. 12-15. R. Cubicciotti, manager of lubricant sales, presided.

A complete review of lubricating problems, together with general round table discussions, highlighted the meetings. Papers scheduled for presentation include: "Steam Cylinder Lubrication," "Mine Lubrication," "Tractor Lubrication," and "Truck Fleet Lubrication." On Wednesday, Feb. 14, the entire day was devoted to study and discussion of research exhibits and demonstrations at the company's Oleum refinery.

Smith Meter Co. At Tulsa Oil Show

One of the companies which has definitely announced their plans for participating in the International Petroleum Exposition of 1940, at Tulsa, is the Smith Meter Co., of Los Angeles. Smith Meter, a subsidiary of A. O. Smith Corp., Milwaukee, has made remarkable strides in the metering field during the past year. According to H. F. Detrick, president of the company, their exhibit will include not only operating models of truck, pipe line, loading rack and refinery meters, but meters for handling butane and propane gases as well.

One of the latest products to be brought out by the Smith organization is the Smithway Centrifugal pump, which, it is said, makes possible the pumping of extremely large capacities at high heads in relation to size and weight of pump.

Mid-Continent representatives of the company will be in attendance at the show as well as a number of officials from the Los Angeles office. More complete details of the exhibit will be released at a later date.

Glenn E. Henderson Joins Alford Pump

From John Alford, president of the Alford Pump Co. of Long Beach and Taft, comes the announcement that, effective Feb. 1, Glenn E. Henderson is to be associated with the Alford sales organization.

Glenn E. Henderson

Mr. Henderson is an experienced pump man, having been connected with several of the oil industry's leading pump manufacturers. Mr. Henderson's operations will cover the entire West Coast but his headquarters will be out of the home office in Long Beach.

B. E. Johnston Represents U. S. Manufacturers in S. A.

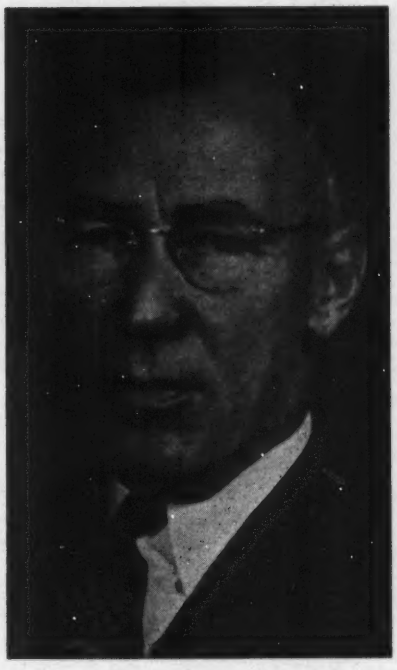
B. E. "Buddy" Johnston, who has been visiting the states on business for several weeks, reports that he is returning to South America about the middle of February to represent E. M. Smith Co. of Los Angeles, Calif.; Globe Oil Tools Co. of Los Nietos, Calif.; and The MacClatchie Mfg. Co. of Compton, Calif.

As direct factory representative for these companies he will cover all the active oil fields of Trinidad, Venezuela and Colombia at regular intervals; providing direct contact between the manufacturers and users of their products.

Mr. Johnston has been located in South America during the past twelve years, and therefore is thoroughly familiar with all the South American oil fields, drilling and operating conditions, et cetera. He enjoys a wide acquaintance among oil men throughout the southern hemisphere, and his many friends there will be glad to learn of his new connections as well as his early return.

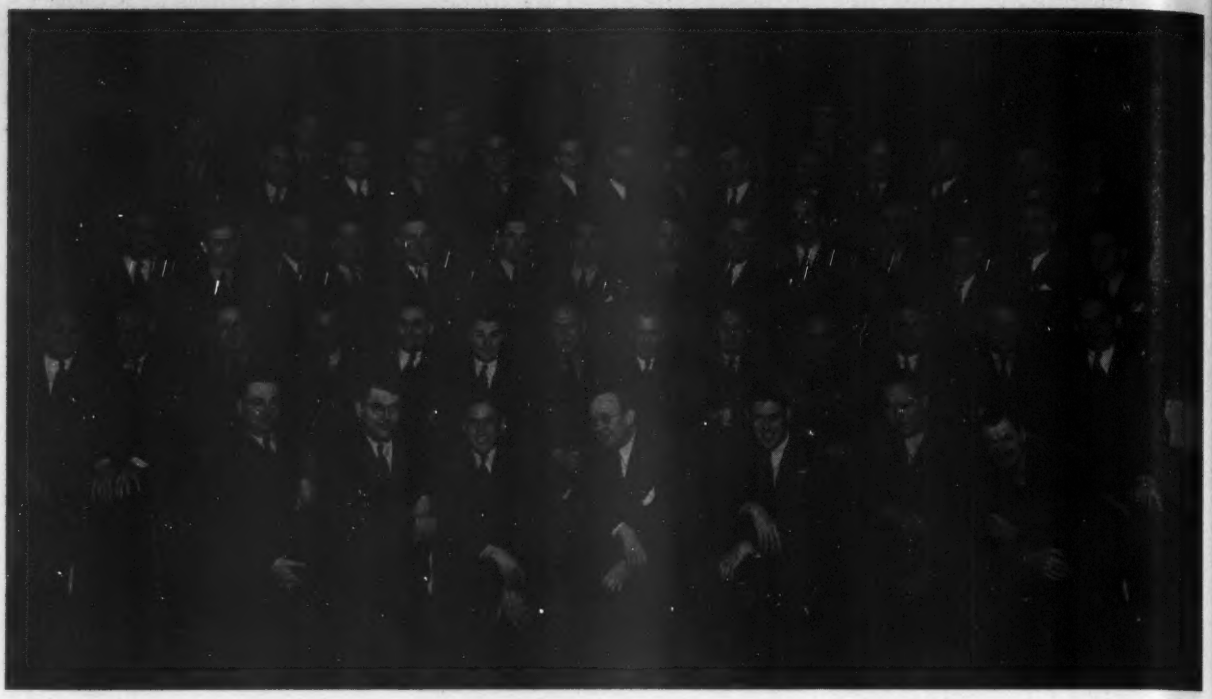
Low Heads California John A. Roebling's Sons

E. C. Low has been elected president and general manager of John A. Roebling's Sons of California, effective January 1, 1940, to succeed F. W. Hammond, who is retiring after 41 years of service. Other elections announced were: W. A. Anderson, vice president; E. T. Zeoli, treasurer; H. D. Tuttle, secretary, and H. R. Brown, assistant treasurer.



E. C. Low

Announcement was also made of the appointment of E. A. Trask as sales agent and manager of the San Francisco branch.



Kneeling, reading from left to right: L. R. Austin, H. E. Hougen, P. Shelley, P. E. Fitzgerald, L. D. Smithers, C. M. Bryant, R. A. Brewer. First row, seated: J. Cummin, W. W. Love, M. W. Frack, H. W. Ross, Dr. J. J. Grebe, J. H. Adkison, C. E. Mangold, L. A. Courter, N. R. Crawford, vice-president and general manager of Dowell Incorporated; A. P. Beutel, Dr. W. H. Dow, F. Holland, R. D. Shaw, sales manager. Second row, standing: Dr. W. R. Veazey, D. G. Hefley, W. D. Miller, W. B. Tennis, F. I. McConnell, W. E. Reardon, G. L. Leach, W. J. Russell, J. H. Courtner, J. G. Staudt, O. N. Maness, J. B. Stone, G. F. Williams, J. L. Coss. Third row, standing: W. S. Day, Ormand Barstow, N. D. Griswold, Dr. C. F. Prutton, A. O. Bedford, R. L. White, K. L. Flanders, Dr. F. N. Alquist, L. W. Lee, J. J. Johnson, C. Penhaligen, M. L. Stirling, O. W. Lyons. Fourth row, standing: J. H. Finney, D. L. Conner, C. T. Young, L. C. Chamberlain.

Dowell Inc. Convenes in Tulsa

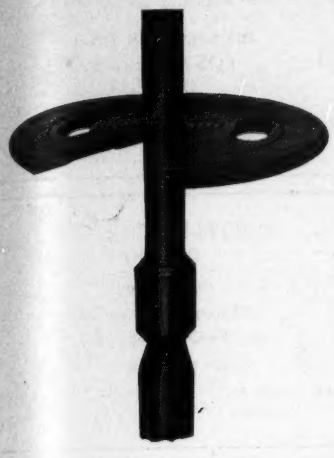
During the week of Jan. 7, Dowell's general office headquarters, Tulsa, Okla., was the focal point for a nation-wide migratory movement comprising 51 Dowell executives, technicians, geologists, sales and advertising representatives and their wives. The purpose of the meeting was the Annual Convention of Dowell Incorporated which this year marked the eighth anniversary of the founding of the company and the perfecting of inhibited acidizing for oil and gas wells. Representatives came from every principal oil producing area in this country. Attending from distant points were Dr. W. H. Dow, president of The Dow Chemical Company; A. P. Beutel, president of Dowell, Drs. Grebe, Veazey, Alquist, and Messrs. Lee, Penhaligen, Griswold and Barstow, all from Midland, Mich., who were accompanied by their wives. Dowell's Canadian office was represented by Mr. and Mrs. W. B. Tennis. Their advertising agency, MacManus, John & Adams, Inc., Detroit, was well represented too, as Messrs. R. A. Brewer and H. E. Hougen accompanied by their wives also made the trip.

Evenings were devoted to social affairs, the high spot being a chuck wagon dinner with everyone dressed in costumes representative of the days in the Southwest 50 years ago.

Aiding the cause of the Rice Bowl in San Francisco's Chinatown, Evans' Associated service station in the downtown financial district provided free parking for the three nights of the celebration. To show their appreciation, Elizabeth Wu (with the gas hose), Betty Chan (polishing glass) and Marian Quan (at radiator) render smiling Associated service to an incoming motorist.

Patterson-Ballagh Improved Pipe Wiper

Since introduction of the large rubber pipe wiper several months ago, engineers of Patterson-Ballagh Corp. have made an improvement in the product.



Because of the size of the disc, use of a solid, molded piece of rubber prevents the driller from observing the mud level in the casing. Therefore, the product has been redesigned with large peek holes so that the operator can watch the mud level drop when swabbing. This pipe wiper is made in five sizes, diameters ranging from 9½" to 19", to fit any size drill pipe. Because of its flexible center, it cleanly wipes mud or muck from the drill pipe and does not hinder collars and protectors from coming up through the wiper. This improved wiper is made from specially molded rubber, reinforced at the periphery with a flat metal inserted disc. No metal is exposed. By designing windows in the web, there is a saving in weight, but no reduction in the strength of the rubber. The wiper is placed under the rotary table. Further details may be obtained from Patterson-Ballagh Corp., 1900 East 65th Street, Los Angeles, Calif.

High Pressure Lubricated Gauge Line Plug Cock

To provide a leakproof gauge cock which can be completely opened or closed with ¼ turn, engineers of Merco Nordstrom Valve Co. have developed a

lubricated type for test pressures up to 4000 lbs. This gauge cock has a rated working pressure for water, oil and gas of 2000 lbs. Its body is forged steel and it has a stainless steel plug. Stick lubricant is inserted under a lubricant screw which can be turned down. Turning of the screw transmits hydraulic pressure to the seat, and in the event the cock becomes hard to turn, the pressure exerted will loosen it. Special lubricants are available for steam. This gauge cock is made in ¼" and ⅜" sizes and is wrench-operated. Details may be obtained from Merco Nordstrom Valve Co., 400 Lexington Avenue, Pittsburgh, Penn.

Merco Concentrator Perfected For Maintaining Mud-Weight

In drilling operations, the factor of maintaining rotary drilling mud at its proper weight usually entails a considerable waste of costly weighting material. When rotary drilling mud picks up colloids, it becomes thick and viscous. In order to reduce this viscosity, water must be added, which results in a lessening of the mud weight. More weighting material must then be added to the diluted mud to restore it to the desired weight. Due to this addition of water and weighting material, the volume of mud is increased and a disposal of the surplus weighted mud becomes necessary. If the mud, however, accumulates gas and water, its viscosity and weight decrease. This, likewise, requires the addition of weighting material and the discarding of the surplus volume of weighted mud.

The new Merco Type A-24 Concentrator has been specifically designed and perfected to maintain mud-weight without the needless waste of surplus weighting material. Under this method the Merco Concentrator is installed adjacent to the mud ditch, where it takes off a small portion of previously desanded mud (from 10 to 25 gallons per minute). This may be diluted with 1 to 2 parts of water. The diluted weighted mud is then centrifuged and the weighting material concentrated in the underflow, from where it is again remerged with the circulating mud stream. The colloids, gas and excess water are decanted in the overflow of the Merco Concentrator and go to waste. Any desired concentration may thereby be obtained up to a density of 120 lbs./cu. ft. It is not necessary to operate the Concentrator continuously, but only so long as the weight of the mud from the well is decreasing or the viscosity is increasing. If it is desired, the mud weight can be reduced by diverting weighting material to storage. Upon completion of the well, the residual mud can be treated for reclamation of the weighting material in a highly concentrated fluid for storage or further use. The new Merco Type A-24 Concentrator differs from the Merco Type A-24 Desander in application and construction. The Merco Concentrator is designed for concentrating mud-weighting material, while the Desander is designed for extracting sand and cuttings from the mud. The Concentrator is constructed for much higher speed and has other refinements not embodied in the Desander.

A new bulletin, No. X-244, is available with flow chart, describing this new machine. It may be secured by writing Merco Centrifugal Co., 343 Sansome St., San Francisco, Calif.

Streamlined to the tempo of 1940, Union Oil Company's annual advertising and sales meetings for dealers and employees feature a color-sound motion picture, in addition to an all-professional stage presentation. Primarily designed to familiarize the sales personnel with the company's advertising plans for the coming year, this year's series of meetings also commemorate Union Oil's 50th anniversary. Under the supervision of R. L Philippi, director of public relations and advertising, major meetings are planned for eleven key Pacific Coast cities during February and March.

New idea for an automobile license is a translucent colored plate illuminated by a light behind it.

You are reading the Pacific Coast oil men's home paper.

Business and Professional Directory

THE
HANCOCK OIL COMPANY
of
CALIFORNIA

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MARKETERS

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1110 Security Title Insurance Bldg.
Los Angeles, Calif.
TRinity 9705

MARTIN VAN COUVERING
PETROLEUM ENGINEER
405 South Hill Street
LOS ANGELES
CALIF.
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GERARD HENNY, Ph.D.
Consulting Geologist
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small type: 50c per line per insertion. Count six words to a line. Minimum charge $2.00. All classified advertising payable in advance. Four consecutive insertions at price of three, if copy does not change.

24 times .....$ 7.50 per inch
1 time ..... 10.00 per inch
Not responsible for more than one incorrect insertion.

NOTICE OF SALE OF OIL ROYALTIES TO LIQUIDATE RECEIVERSHIP ESTATE

The District Court of the United States, Southern District of California, Central Division, has ordered sold, for cash, to the highest bidder on March 7, 1940, at two o'clock P. M., at the Broadway Entrance of the Hall of Records, Los Angeles, California, the following royalties, to-wit: .....

(1) **ACME LEASE—**
5% overriding royalty in Well No. 1, and 10% overriding royalty interest in Wells Nos. 2 and 3, situated on Lots 1 to 16 and 25 to 30, North Long Beach Tract, County of Los Angeles, State of California.

(2) **BISHOP LEASE—**
2.083% overriding royalty interest in Lots 1 and 3, Block 316, Huntington Beach, County of Orange, State of California.

(3) **SEEPLE NO. 6 WELL**
A 2% participating royalty interest in North ½ of Lot 12, Block "A," Mountain Meadow Tract, Signal Hill (Long Beach), County of Los Angeles, State of California.

(4) **BIDDLE LEASE—**
A participating royalty interest in four wells—1/12 of 1% in Wells Nos. 29 and 30; 1/24 of 1% in Wells Nos. 31 and 32, situated on Lots 12 and 13, Block 52, Santa Fe Springs, County of Los Angeles, State of California.

(5) **WHISTON AND COX LEASE—**
1% of 40%, or 0.4 of 1%, participating royalty interest in three wells, known as Alexander Nos. 1 and 2, and Rhode No. 3, situated on Lot 6, Block 82, Santa Fe Springs, County of Los Angeles, State of California.

(6) **CRAWFORD 1A LEASE—**
A 1 1/24% landowner's royalty interest in Lots 2 and 3, and 2/3 of Lot 4, Block 88, Santa Fe Springs, Los Angeles County, State of California.

(7) **SIMPLEX LEASE—**
A 20% participating royalty interest in Well No. 20, and a 5% overriding royalty interest in Well No. 26, situated on Lots 87 to 90, inclusive, North Long Beach Tract, County of Los Angeles, State of California.

(8) **HANCOCK LEASE—**
A 1% landowner's royalty interest in Wells Nos. 13 and 14 situated on Part of Lot 11, Block "H," Signal Hill, County of Los Angeles, State of California.

(9) **GIBSON LEASE—**
A ¼ of 1% landowner's royalty interest in a sixty acre tract, under lease to the Union Oil Company of California, in Section 36, Township 27 South,, Range 20 East, M. D. B. & M., County of Kern, State of California.

(10) **ARCHER LEASE—**
A ½ of 1% overriding royalty interest in well and lease of Lot 10, Block 68, Santa Fe Springs, County of Los Angeles, State of California.

(11) **PULLIAM NO. 1 LEASE—**
A 1% participating royalty interest in Lots 15 and 16, Block 87, Santa Fe Springs, County of Los Angeles, State of California.

(12) **BUCKBEE LEASE—**
A 1/176 of 1% overriding royalty interest in the Buckbee 1A Well, and a 130/366 of 1% overriding royalty interest in the balance of the Buckbee wells located at Santa Fe Springs Oil Field, County of Los Angeles, State of California.

(13) **KOONTZ LEASE—**
A 3/200 of 1/173 of 1% overriding royalty interest in the entire Koontz Lease located at Santa Fe Springs, County of Los Angeles, State of California.

(14) **ELLIS LEASE—**
A 1/240 of 1% participating royalty interest in the Ellis Lease, located at Santa Fe Springs, County of Los Angeles, State of California.

(15) **SUNSET PACIFIC NO. 3 LEASE—**
Nature and extent of royalty interest, if any, and exact legal description unknown. Lease is located at Santa Fe Springs, County of Los Angeles, State of California.

(16) **PORTER NO. 2 WELL—**
Nature and extent of royalty interest, if any, and exact legal description unknown, lease is located at Signal Hill, County of Los Angeles, State of California.

(17) **SANTA BARBARA LEASE—**
A 1½% participating royalty interest in the Santa Barbara Lease located at Santa Barbara Mesa, County of Santa Barbara, State of California. Exact legal description is unknown.

For terms of sale and further particulars apply to undersigned.
JOSEPH J. RIFKIND, Receiver in Equity of Pan California Oil Corporation, 535 Rowan Building, Los Angeles, TRinity 4152. 2/20/b

EXECUTIVE WANTED

A large, non-major, integrated oil company desires an

Assistant to
Vice President
in Charge of Production

Applicants must have experience in exploratory development and be capable of advancing to head of production department. Our client's employees are advised of this advertisement, so have no hesitancy in sending full particulars which will be held strictly confidential.
Address: J. C. Bull, Inc., 101 Park Ave., New York, N. Y. 3/5b

FINANCING

Complete financing service includes: geological and economic investigation—incorporation—application for stock sale permit—S E C Registration—prospectus preparation and stock sales management. Only high grade oil or gas deals considered. ADVERTISER, Box 28, c/o California Oil World. 2/20d

MAPS

Large maps of Los Angeles Basin oil fields and map showing all California oil fields. Price $15.00 each on paper and $20 each on cloth. Individual state oil and gas maps of Mid-Continent and Rocky Mountain regions. Maps show geological cross sections at base. These maps indicate wells drilling, wells producing and abandoned, with depths.
All maps revised up to date of purchase.
JAMES C. BRANSFORD
1127 Story Bldg.
Los Angeles, Calif.
Phone: TUcker 7530

California Crude Oil Production

Two Weeks Ended February 10, 1940

	February Daily Quota	Average Daily Production	Excess
San Joaquin Valley			
Belridge—North	12,196	11,197	*999
Belridge—South	2,037	1,920	*117
Buena Vista	16,420	16,330	*90
Canal	5,664	6,049	385
Coalinga-E. (Eocene)	12,025	10,132	*1,893
Coalinga—East-West	15,299	9,620	*5,679
Cole's Levee	4,061	4,038	*23
Edison	2,205	2,213	8
Elk Hills	7,507	12,616	5,109
Fruitvale	6,078	5,724	*354
Greeley	3,356	2,594	*762
Kern Front	7,273	6,199	*1,074
Kern River	6,796	4,034	*2,762
Kettleman No. Dome	34,030	46,757	12,727
Lost Hills	3,948	4,190	242
McKittrick	3,670	3,435	*235
Midway	36,765	36,908	143
Mount Poso	9,819	9,864	45
Mountain View	9,004	9,736	732
Rio Bravo	7,400	7,295	*105
Round Mt. and Coffee Canyon	7,346	8,025	679
Ten Section	8,436	8,274	*162
Wasco	1,300	870	*430
Other Fields	3,602	3,114	*488
TOTAL	226,217	231,134	4,917
Coastal Counties			
Elwood	3,626	3,984	358
Rincon	2,580	4,098	1,518
Santa Maria	6,142	3,572	*2,570
Gato Ridge	2,350	148	*2,202
Santa Maria Valley	18,072	11,302	*6,770
Santa Paula-Newhall	5,828	6,380	552
Ventura Avenue	31,159	38,355	7,196
Other Fields	5,242	5,387	145
TOTAL	74,999	73,226	*1,773
Los Angeles Basin			
Alamitos-Seal Beach	7,222	8,424	1,202
Brea-Olinda	7,945	5,419	*2,526
Coyote—East	3,437	3,103	*334
Coyote—West	9,942	7,762	*2,180
Dominguez	16,472	20,474	4,002
El Segundo	2,521	2,888	367
Huntington Beach—New and Old	23,050	26,218	3,168
Inglewood	12,695	12,528	*167
Long Beach	39,488	45,732	6,244
Montebello	5,829	5,622	*207
Montebello-West End	22,962	19,784	*3,178
Playa del Rey	4,023	4,357	334
Richfield	7,166	8,360	1,194
Rosecrans-Athens	7,837	9,719	1,882
Santa Fe Springs	24,239	25,954	1,715
Torrance	5,218	5,248	30
Torrance "34" and "D & B"	6,662	7,516	854
Wilmington	78,787	83,239	4,452
Other Fields	3,998	4,092	94
TOTAL	289,493	306,439	16,946
STATE TOTAL	590,709	610,799	2 ,090

*—Shortage.